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THE
MARINE OBSERVER

A Quarterly Journal of Maritime Meteorology
prepared by the Marine Division of the
Meteorological Office

Vol. XLII

1972

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A QUARTERLY JOURNAL OF MARITIME METEOROLOGY PREPARED BY THE MARINE DIVISION OF THE METEOROLOGICAL OFFICE

VOL. XLII No. 235 JANUARY 1972

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Letters to the Editor, and books for review, should be sent to the Editor, "The Marine Observer," Meteorological Office, Eastern Road, Bracknell, Berkshire RG12 2UR

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Editorial

The Contracting Governments undertake to encourage the collection of meteorological data by ships at sea and to arrange for their examination, dissemination and exchange in the manner most suitable for the purpose of aiding navigation.

With this preliminary instruction does the International Convention for the Safety of Life at Sea require its signatories to provide a meteorological service for shipping ". . . to warn ships of gales . . . to issue daily, by radio, weather bulletins suitable for shipping . . . to arrange, if practicable, for the publication and making available of daily weather charts for the information of departing ships . . .".

The meteorological obligations of the Contracting Governments, represented in this sphere naturally by their meteorological offices, are wide but the Convention makes actually only one such demand on the shipmaster; that he shall, if he "meets with dangerous ice, a dangerous derelict, or any other direct danger to navigation, or a tropical storm, or encounters sub-freezing air temperatures associated with gale force winds causing severe ice accretion on superstructures, or winds of Force 10 or above on the Beaufort scale for which no storm warning has been received, communicate the information by all the means at his disposal to ships in the vicinity and also to the competent authorities at the first point on the coast with which he can communicate."

The link between the two is given in the first paragraph above: that we shall *encourage* ships to collect meteorological data or, in other words, to keep meteorological logbooks and send radio weather messages. The word emphasizes the voluntary nature of weather observing at sea.

Sailing in company with the Voluntary Observing Fleet and, like it, dedicated to the safety of life is another large body of craft also working on a voluntary basis: craft operated by the Royal National Life-boat Institution. This body was founded in 1824 though two of the stations which it now controls, Sunderland and Montrose, were manned as long ago as 1800, to be followed by three more in 1801 and nine in 1802. The lifeboat service is thus many years senior to the Voluntary Observing Fleet but, though professionally neither would wish to see much of the other, the two services could be said to be complementary. *The Times* of 10th February 1862, the Meteorological Office then being only 8 years old, recognized this in the words "the growth of this new department [the Meteorological Office] seems to bear the same relation to the Shipwreck Relief Society and the Life-boat Society that preventive medicine does to remedial medicine. Indeed, as we progress in knowledge, we are beginning to find out that prevention is better than cure and, what is more to the purpose, we are becoming enabled to put this prevention into practice." So this is the way we keep station on each other, one to prevent, the other to cure.

Calls on the lifeboat have increased phenomenally over the years; in 1925 the service answered 204 calls, in 1959 the number was 865 whilst in 1970 it had risen to 2,633. But the percentage number of these calls made by merchant ships, both foreign-going and home trade, seems to have decreased year by year. These are the responsible users of the coastal waters, professional mariners who will listen to weather forecasts and act accordingly; perhaps we may be so bold as to believe that the steady improvement in the coastal weather services, both in matter and in dissemination, which *The Times* of 1862 might have called our preventive medicine, has helped in the reduction of these figures.

Unhappily there are still the irresponsible others who will venture out to sea without regard to the impending weather and to cater for these without the expense of employing a large conventional lifeboat the R.N.L.I. decided in 1963 that it would be worthwhile to float a number of inshore rescue craft, boats powered with an outboard engine, manned by a crew of two, with a capacity of eight survivors and a speed of 20 knots. These inshore rescue craft are called out rather more often than the larger boats and their calls are largely to pleasure craft, sailing, powered or

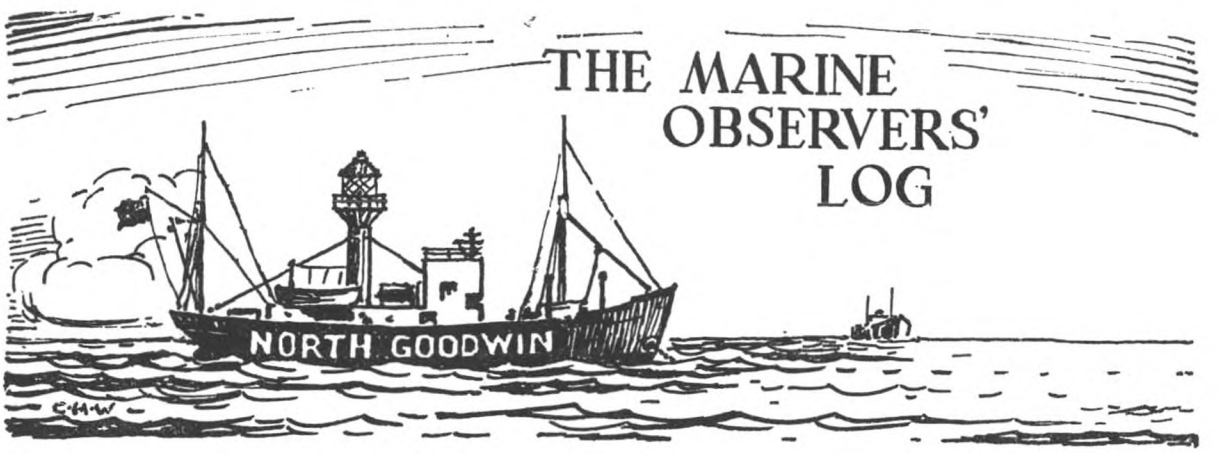
manually operated, bathers, skin divers, water skiers and, occasionally, to holiday makers cut off by the tide. These unhappy people, many of whom might so easily and painlessly have taken our preventive medicine which is so readily available through the BBC, the telephone or even the daily newspaper, have been forced to take the more costly and usually unpalatable remedial medicine provided by the senior partner in the team.

That weather is still a major cause of disaster at sea is borne out by *Lloyd's Register of Shipping Statistical Summary of Casualties* for 1970. This shows that of the 352 ships totally lost during the year, which incidentally is the highest peacetime figure for 50 years, 140 foundered (another record), 93 were wrecked either by stranding, striking rocks or sunken wrecks etc. (weather could have been a contributory cause in some of these), 63 were lost by fire, 40 by collision and 16 in circumstances which, for want of sufficient information, cannot be classified. These sobering figures are emphasized by a study of the casualty returns for August 1971, which deal with all casualties to ships, not only total losses. This return mentions 50 ships, 17 of which were weather casualties including the Hong Kong *Fatshan* of 2,637 gross tons, which capsized and sank with heavy loss of life during Typhoon Rose on August 16th–17th, and the Liberian *Dora* of 9,482 gross tons which ran aground in fog at the entrance to the Vridi Canal (Ivory Coast, West Africa) at 0500 on 23rd August and which was subsequently abandoned.

It all points to the fact that there is still much to be done before we can be reasonably satisfied that we are fulfilling our appointed function properly. To come to terms with the weather is the best that the meteorologist can ever hope for; it would be arrogant and heretical to believe that he will ever be able to control it and, if unaided by the voluntary observer at sea, he would be unable even to do this. With the best will in the world, and were he able to set up an observing station on every square mile of land, his network would still cover less than a quarter of the world's surface. The other three-quarters, moreover the area which is the birthplace of most meteorological phenomena, are the province of the voluntary marine observer.

It falls pleasantly to the lot of the writer of the Editorial to wish all marine observers, whether at sea, in port or home on leave, a happy New Year. May 1972 be for all a year of happiness, prosperity, good landfalls and reasonable weather.

L. B. P.



January, February, March

The Marine Observers' Log is a quarterly selection of observations of interest and value. The observations are derived from the logbooks of marine observers and from individual manuscripts. Responsibility for each observation rests with the contributor.

Observing officers are reminded that preserved samples of discoloured water, luminescent water, etc. considerably enhance the value of such an observation. Port Meteorological Officers in the U.K. will supply bottles, preservative and instructions on request.

CYCLONE 'GINETTE'

Indian Ocean

s.s. *Bencruachan.* Captain J. R. Rodger. Durban to Hong Kong. Observers, the Master and Mr. R. Hay, 2nd Officer.

23rd January 1971

GMT

0530: Vessel received first warning from Mauritius Radio of intense tropical cyclone Ginette, position (at 0001) 21° 00′S, 63° 30′E, moving SW at 10 kt.

0900: Position of ship 28° 51′S, 40° 49′E. Course 084°T at 20·3 kt. Pressure 1011·9 mb. Wind E'N, force 4. Air temp. 27·8°C, wet bulb 24·8°. Overcast with occasional light showers. Good visibility. Rough sea. Heavy confused swell.

1300: Wind E'ly, force 5. Pressure 1009·9. Air temp. 27·2°, wet bulb 24·0°. Few clouds. Fine and clear with good visibility. Rough sea. Moderate confused swell.

1700: Wind increased to force 5. Pressure 1010·8 mb.

24th

0600: Position of ship 27° 54′S, 48° 42′E. Ginette centred within 60 miles' radius of 22° 42′S, 58° 00′E, moving WSW at 10–12 kt.

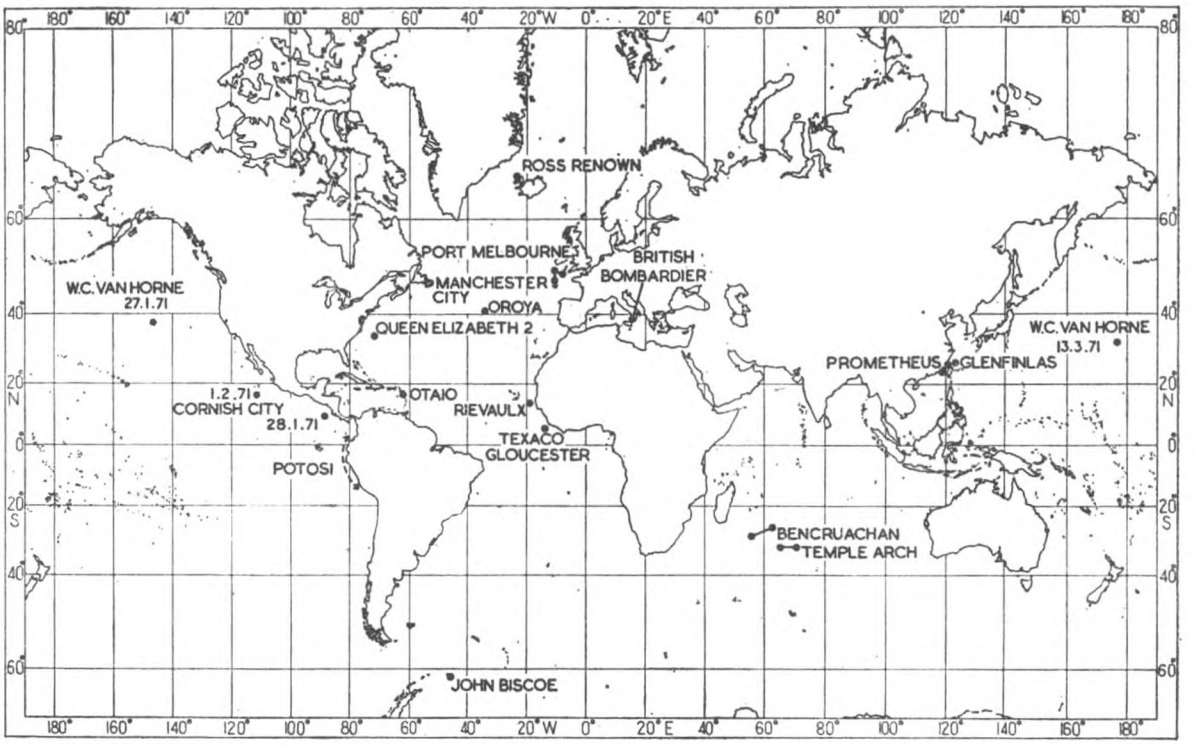
0630: Vessel altered course to 095°T to avoid and pass south of Ginette.

0900: Position of ship: 28° 07′S, 49° 47′E. Wind SE'E, force 6. Pressure 1010·6 mb. Cloudy with good visibility. Rough bow sea and long heavy swell.

1100: Reduced speed to 17·5 kt due to stress of weather.

1200: Ginette centred within 60 miles' radius of 23°S, 57°E, moving WSW at 10–12 kt.

2100: Wind SE'E, force 7. Pressure 1008·7 mb. Air temp. 25·0°. Overcast with occasional drizzle. Very rough head sea and long, heavy swell. Reduced speed to 13 kt.



Position of ships whose reports appear in "*The Marine Observers' Log*".

25th

0600: Ginette centred within 30 miles' radius of 24° 00′S, 54° 30′E, moving WSW at 8 kt. Hurricane-force winds within 60 miles of centre.

0800: Position of ship 28° 27′S, 56° 22′E. Wind ESE, force 6–7. Pressure 1005·9 mb. Overcast with occasional light showers. Rough sea and heavy swell.

26th

0001: Position of ship 27° 00′S, 61° 00′E. Wind E'ly, force 6–7. Pressure 1001·3 mb. Ginette centred within 30 miles' radius of 25° 16′S, 52° 48′E, moving WSW at 5–8 kt.

0600: Ginette apparently almost stationary within 60 miles' radius of 25° 16′S, 52° 48′E.

0800: Position of ship 25° 49′S, 63° 16′E. Wind NE, force 6–7. Pressure 1003·3 mb. Rough sea and moderate to heavy swell. Vessel now at full sea speed.

27th

0700: Position of ship 22° 27′S, 71° 10′E. Wind NE, force 4. Pressure 1008·2 mb. Few clouds. Very good visibility. Moderate sea and long, moderate to heavy swell.

m.v. *Temple Arch.* Captain D. L. Innes. Fremantle to Immingham. Observers, the Master, Mr. A. L. Davie, Chief Officer, Mr. P. Dyson, 2nd Officer and Mr. J. C. Gibson, 3rd Officer.

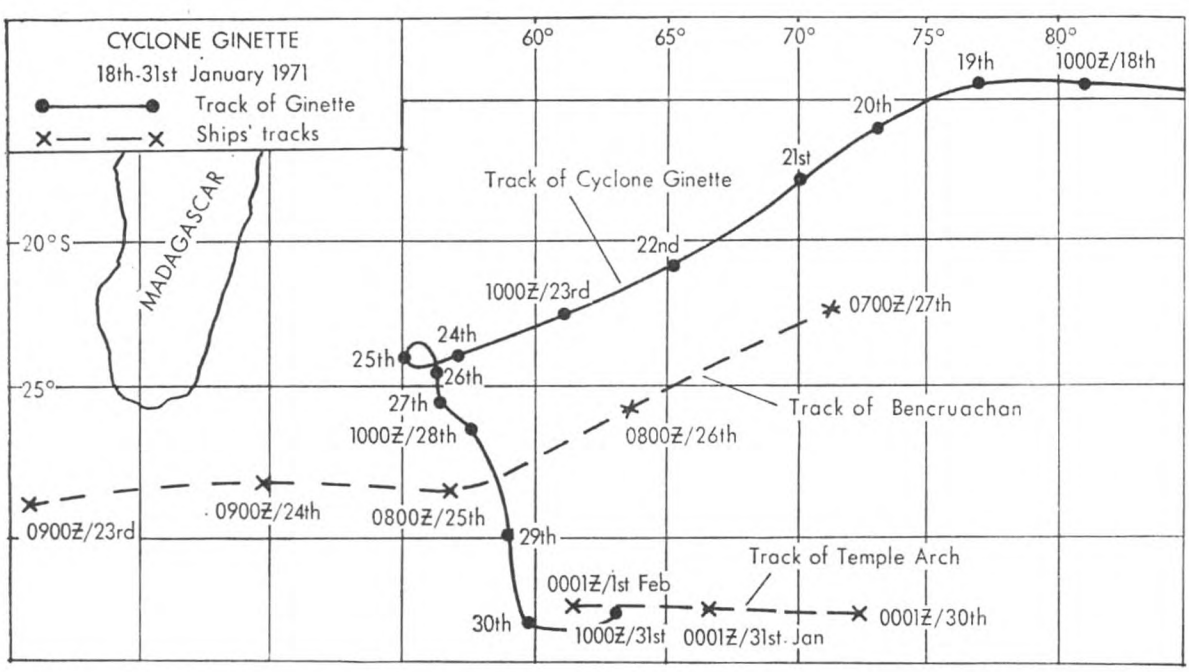
31st January 1971. The weather forecast received from Simonstown at 0600 GMT read: "Warning. Gale-force to extreme gale-force winds of 35–60 kt within 200 miles of Cyclone Ginette, especially in southern sector. Position approx. 33°S, 63°E." Our position at the time was approx. 32° 24′S, 65° 12′E, speed about 10 kt, course. 270°T, which put us 120 miles from Ginette. Our course and speed were maintained and, if Ginette's position, course and speed were accurate, we were 85 miles from

Ginette at 0730, 65 miles at 0830 and 55 miles at 0900. The following observations were made of the wind and pressure:

0600: NW'N, force 7. 1003·3 mb.
0700: NW, force 7. 1003·2 mb.
0800: NW, force 7. 1003·0 mb.
0900: NW, force 4. 1002·0 mb.
1000: NW'W, force 3. 1002·0 mb.
1100: Light airs. 1002·3 mb.
1200: S'E, force 9. 1003·3 mb.
1300: SSE, force 8. 1005·1 mb.
1400: SE'S, force 8. 1006·6 mb.

A very heavy confused swell was present throughout, the more prominent being from the south. At 1400 our course was altered to 290°T as the swell was shifting around to come from the SE and the vessel was beginning to roll very heavily. Intermittent rain showers persisted throughout. As can be seen, the wind shifted through 180° during the 8 hours and in the space of 1 hour from NW'W to S'E. The sky, when visible, was completely chaotic.

Position of ship at 1200: 32° 24'S, 63° 54'E.



Note. Tracks of Cyclone Ginette, obtained from ITOS 1 satellite pictures (*see* photograph opposite page 36), and of the *Bencruachan* and *Temple Arch* are shown in the diagram. Ginette's behaviour was exceptional, not only for the clockwise loop performed at recurvature but also due to the fact that the cyclone showed considerable weakening during the period 22nd to 24th January and then re-intensified in the recurvature zone on the 25th. After recurvature the storm gradually weakened and decayed on 1st February although, as the *Temple Arch* report shows, it was still active on the afternoon of 31st January.

SEVERE ATLANTIC STORMS

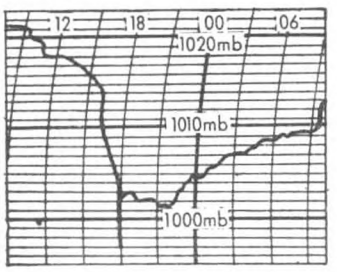
Western North Atlantic

R.M.S. *Queen Elizabeth 2*. Captain W. E. Warwick, C.B.E., R.D., R.N.R. Cruising between New York and West Indies. Observers, Mr. J. R. D. Hall, 1st Officer and Mr. N. H. Osborne, 2nd Officer.

15th January 1971. At 1800 GMT the vessel was on a course of 347°T at 22 kt. The wind was SW'ly, force 5, air temp. 20·5°C, sea temp. 21·0° and pressure 1003·6 mb. We then experienced a violent line squall accompanied by very heavy rain which

lasted for 30 min. During the passing of the squall the barometer fell 7·0 mb then rose 6·3 mb; the wind veered to W'ly and freshened to force 12 which heeled the vessel 8° to starboard. At 1830 the wind veered to N'ly and moderated to force 3; air temp. 16·0°, sea 21·0°.

Position of ship at 1800: 34° 32'N, 72° 15'W.



St. John's, Newfoundland

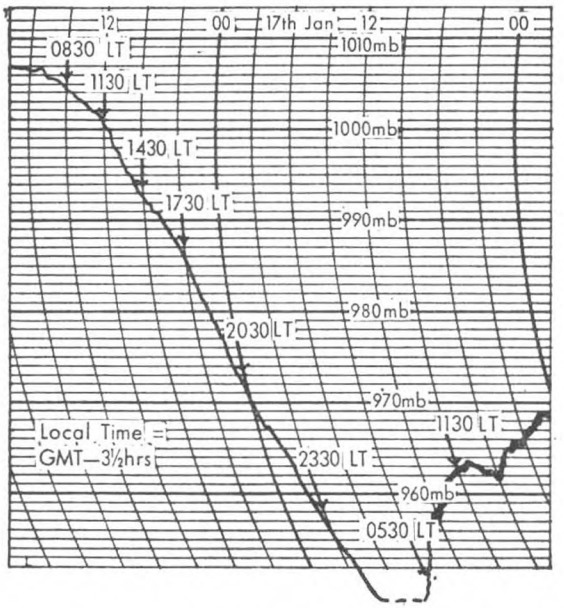
m.v. *Manchester City*. Captain J. E. Askew. At anchor. Observer, the Master.

16th–18th January 1971. The ship was berthed in St. John's, having arrived at 0100 on the 16th. Wind WNW, force 3. Pressure 1005·1 mb and rising slowly. Cloudless with excellent visibility. Air temp. −5·5°C.

During the forenoon the wind shifted to NE and began to increase; warnings of an approaching storm were being given over the local radio stations. By 1500 snow commenced, driven by strong winds, reducing visibility so that it was impossible to see across the harbour.

On cargo being completed, preparations were being made to remain in harbour to ride out the storm. At 2300 gusts of 70 m.p.h. were blowing and a heavy swell was coming through the entrance of the harbour. The ship was ranging alongside so much that the wooden mooring posts forward broke, the ship came adrift and did damage to the wooden wharf. We then proceeded to an anchor in the harbour and rode out the storm.

By 0200 on the 17th the wind had died down and the snow ceased. The pen of



the barograph was off the paper and resting on the flange. The barometer was reading 944·2 mb; the storm centre had been reported as 938 mb. At 0330 the winds had veered to W'ly and increased to force 8 with driving snow, finally settling to SW where again winds of 70 m.p.h. were recorded.

Conditions ashore were chaotic and a state of emergency was called. Shops and schools were closed on Monday the 18th and people were asked by the local radio

stations to keep off the streets while attempts were made to clear the snow. All during the storm we had seen the flashing amber lights of the snow-clearing equipment going back and forth through the town. At least 24 inches of snow fell, it was reported, and with such strong winds there were drifts up to 15 ft in the side streets.

By Monday afternoon the wind had abated, the snow ceased and we sailed, proceeding on our voyage to Montreal.

Position of ship: 47° 35′N, 52° 40′W.

Irish Sea and S.W. Approaches

m.v. *Port Melbourne*. Captain T. G. W. Ward. Liverpool to Cape Town. Observers, the Master, Mr. M. Thwaite, Chief Officer, Mr. P. H. D. Coombs, 2nd Officer and Mr. M. E. Russell, 3rd Officer.

The following summarized account was taken from a very detailed report compiled by Mr. Russell.

20th January 1971. At 0430 GMT the vessel proceeded out of Liverpool Bay and into the Irish Sea. The weather was cloudy with good visibility. From late morning onwards the pressure fell rapidly, from 986·8 mb at 1100 to 967·3 mb by 1900. The wind had been W'S, force 4–6 but it backed to SE'E and increased to force 9 by 2000. At the start of the voyage there was a moderate sea and low swell but in the late afternoon and early evening the sea became very rough with a confused swell, causing the vessel to roll and pitch heavily at times, spraying over all. Course at 2156, 198°T.

Position of ship at 1800: 14 miles SW'W of the Smalls.

21st. By 0200 the vessel had altered course to 220°T and was 18 miles west of Bishop Rock in worsening conditions; speed had to be reduced to 6·5 kt during the 0400–0800 watch. Throughout the night the pressure had fallen very rapidly and reached its lowest reading of 956·5 mb at 0800 in position 49° 25′N, 8° 13′W, but during the morning and afternoon rose extremely rapidly to reach 989·3 mb by midnight. The wind at first was S'ly, force 9–10 but during the forenoon it veered to WNW, force 10–11; later it steadied at NW'W and moderated to force 8. Seas were very heavy, there was a mountainous swell, mainly NW'ly, and the vessel was manoeuvring with difficulty. Late in the day the sea, although still very rough with a heavy confused swell, began to moderate gradually.

Position of ship at 1200: 49° 24′N, 8° 24′W.

22nd. The wind had been NW'W, force 8 at first but later decreased to force 6 and backed during the latter part of the morning to S'W, force 6–7 as the barometer once more began to fall to reach a minimum of about 987 mb around 1500. Pressure then started to rise again to become 995·6 mb by midnight. The wind veered rapidly in the middle of the afternoon and steadied at W'S, force 8 by early evening. The rough seas and heavy swell persisted to the end of the day with the vessel rolling and pitching, spraying and shipping water.

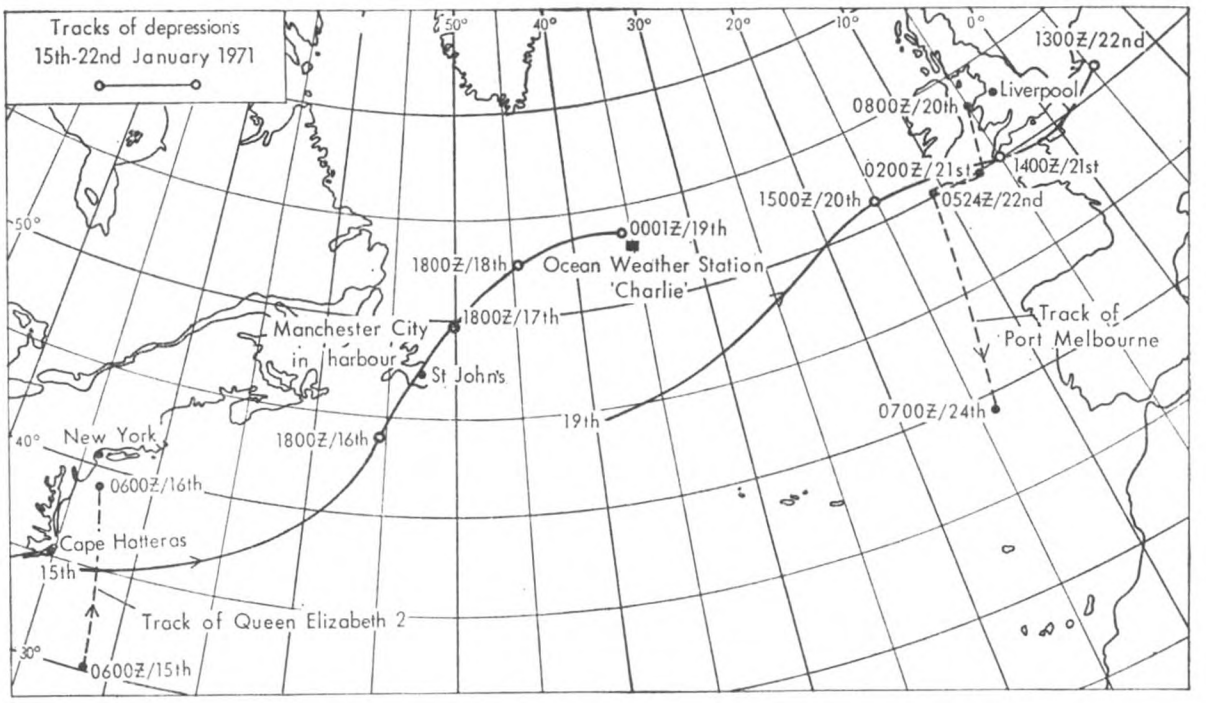
Position of ship at 1200: 48° 22′N, 10° 55′W.

23rd. The wind at first was W'ly, force 7–8 but during the late morning it backed to SSW, force 8. Between 1041 and 1047 the vessel passed through an exceptionally heavy rain squall, the wind veering rapidly to W'S, force 9 with gusts to force 10–11. The engines were slowed to 30 r.p.m. during this period, the vessel rolling and pitching heavily in the rough seas and high W'ly swell. By late evening the wind had steadied at WSW, force 4–5 but the heavy swell still caused the vessel to roll heavily at times, spraying over all. Pressure continued to rise throughout the day, the rate being very rapid during the afternoon and evening, and by midnight was 1019·4 mb.

Position of ship at 1200: 41° 45′N, 11° 21′W.

24th. At 0001 the vessel altered course to 198°T to avoid excessive rolling in moderate to rough seas with a heavy W'ly swell. The wind was mainly WSW'ly, force 5–6 but the pressure continued to rise and was 1026·5 mb by midnight.

Position of ship at 1200: 37° 56′N, 13° 02′W.



Note 1. Conditions over the North Atlantic were particularly disturbed for much of the latter half of January by a series of deep depressions. The one which affected the *Queen Elizabeth 2*, and later the *Manchester City*, developed off Cape Hatteras on the 15th and deepened 'explosively' as it moved NE towards Newfoundland. This storm passed just ahead of the liner during the evening of the 15th (see diagram) and the ship was lashed by its particularly active cold front. The barograph trace from the *Queen Elizabeth 2* gives a rare indication of the initial deepening of a vigorous depression. This same storm passed over St. John's early on the 17th and the narrative now switches to the report from the *Manchester City*. From this account the ship's officers can perhaps be excused for not resetting the barograph when the pen left the chart! The central pressure of 938 mb at St. John's is extremely deep, though a few Atlantic depressions have exceeded this value. After passing St. John's the depression continued NE and decayed on the 19th in the vicinity of Ocean Weather Station 'Charlie' as the next depression of the series was born about 600 miles to the SSW (see diagram). The new depression seriously affected the *Port Melbourne* in the S.W. Approaches. The continued strong to gale-force winds experienced by this ship on the 23rd and 24th were due to yet another deep depression travelling ENE to the north of the ship.
Note 2. The *Port Melbourne* is an Australian Selected Ship.

COLD-FRONT SQUALL

North Atlantic Ocean

m.v. *Oroya*. Captain R. Thomas. London to Bermuda. Observer, Mr. T. J. Sax, Chief Officer.

16th March 1971. At 0830 GMT the vessel was proceeding at reduced revs., due to her light condition, in a moderate to heavy SW'ly sea and swell. The barometer was reading 1007·2 mb and falling rapidly when we passed through a violent squall. Visibility dropped to zero due to horizontally-driven rain; the wind force was of such velocity as to slow the clear-view screens down to a few revs. per minute and I estimated the wind speed to be at least 100 kt. The squall lasted about two minutes then the wind decreased to about force 6 and veered rapidly to W'N: the barograph showed a vertical rise of about 2 mb and the moderate to heavy swell was flattened out within a few minutes.

Position of ship: 41° 00'N, 34° 40'W.

Note. The *Oroya* was struck by the particularly vicious cold front of a deepening secondary depression which passed to the north of the vessel.

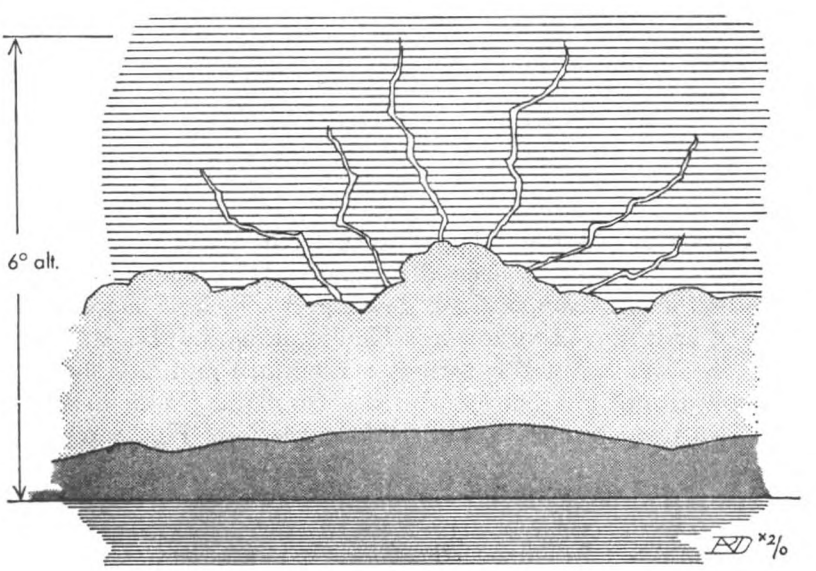
LIGHTNING

Ionian Sea

s.s. *British Bombardier*. Captain T. J. Taylor. Tripoli to Genoa. Observers, Mr. P. N. Duffield, Extra 2nd Officer and Mr. D. Houston, A.B.

27th March 1971. At 0120 GMT, during a period of thundery showers, lightning was observed to the NW striking upwards from the clouds which, when illuminated, seemed to be Cb. Several strokes of lightning were seen to discharge upwards simultaneously, radiating from a point below the top of the clouds. There seemed to be no simultaneous downward strokes, nor were there any flashes visible from that direction for a few minutes previous to and after the described flash. No thunder was heard. Afterwards, numerous flashes were seen in the same direction but at no time were the upward strokes again observed.

Position of ship: 37° 40′N, 16° 26′E.



Note. Single discharges from Cb cloud tops to space have occasionally been observed, but the observation of several simultaneous discharges is extremely rare.

SEVERE ICING

off N.W. Iceland

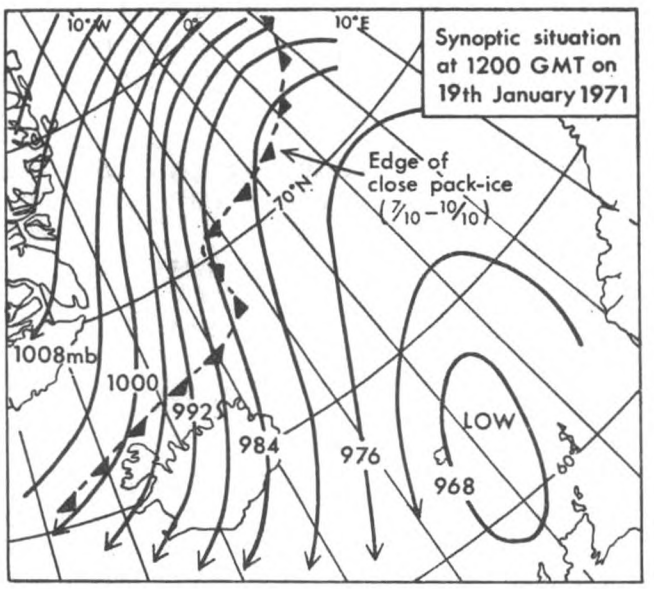
m.t. *Ross Renown*. Skipper B. McCall. At the fishing grounds. Observers, the Skipper and Mr. J. L. Thorpe, Radio Operator.

18th–20th January 1971. At 1430 GMT on the 18th, during fishing operations off the north-west coast of Iceland, the surface wind was NE'ly, force 6 and the sea temperature 4°C. The air temperature gradually fell to −12·2°C; visibility was reduced to 400 yd and sometimes nil by black frost being blown along the surface of the sea, giving the effect of the sea 'boiling'. Heavy frosting was experienced on the ship's superstructure and, on advice from the British support ship *Miranda*, we took shelter in Dyrafjord. While sheltering there the air temperature at 0001 on the 19th had fallen to −13·9° with the sea temperature a steady 4°.

These weather conditions persisted for 48 hours and shortly after this we were able to resume fishing operations.

Position of ship at 1430 on 18th: 67° 00′N, 23° 50′W.

Note. During the period 17th to 20th January a vigorous depression passed to the south and east of Iceland, resulting in strong to gale NE'ly winds in the Denmark Strait. At their onset early on the 18th these winds, which had lately raged over the Greenland Sea ice (see diagram), caused air temperatures around the Horn to drop from near 0°C to minus 10–15°C, finally recovering to 0°C on the 21st as the winds became light. The conditions which prevailed from



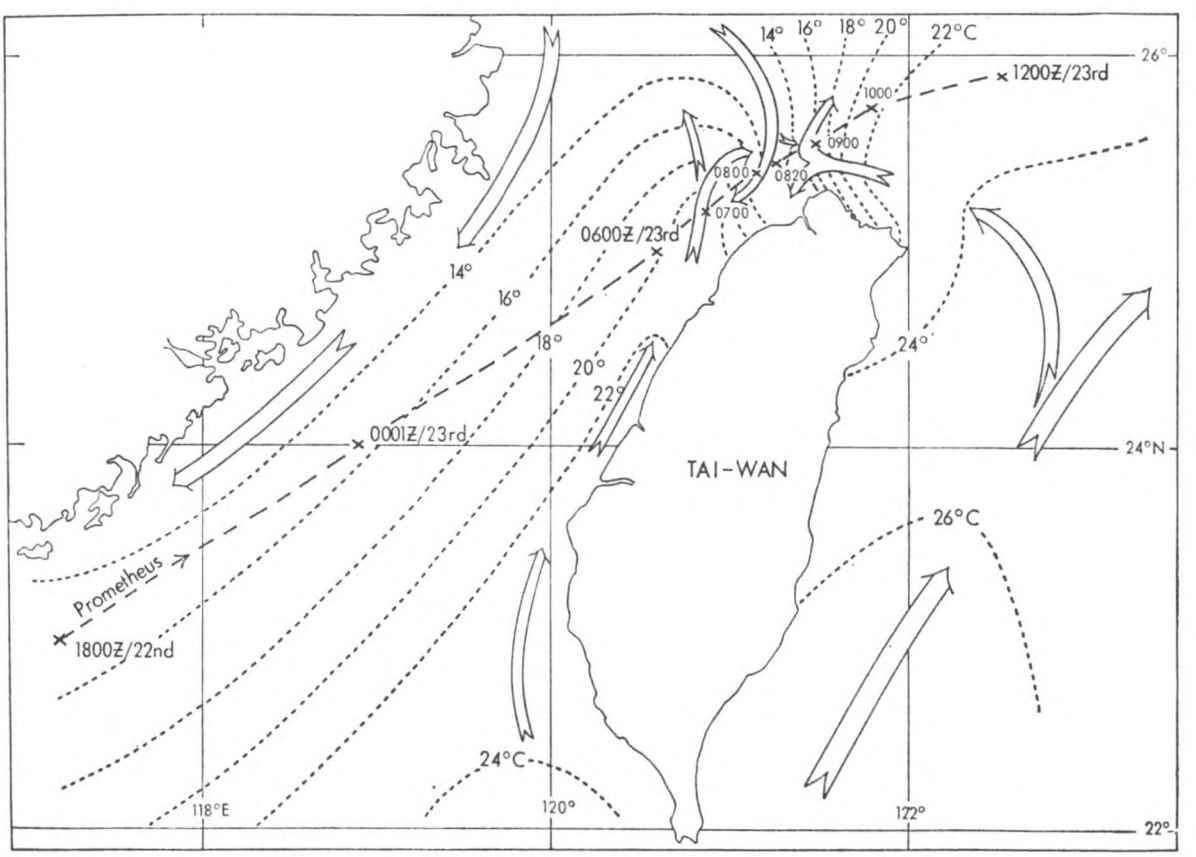
18th to 20th were conducive to the formation of superstructure icing and Arctic sea smoke—known as black frost to the fishermen. In these conditions (air temperatures falling to well below 0°C and strengthening winds) the formation of black frost can sometimes indicate that superstructure icing (from spray) will soon become a serious hazard.

STRONG CURRENTS

Taiwan Strait

m.v. *Prometheus*. Captain F. N. Curphey. Hong Kong to Yokohama.

23rd March 1971. From 0700 to 1000 GMT, while the vessel was proceeding to Japan through the Taiwan Strait, large fluctuations in sea temperature were noticed with correspondingly large fluctuations in the vessel's speed although engine revs. remained constant throughout, delivering 20·4 kt. The wind during that period was steady at NNE, force 7 and the sea waves were 4–7 m high, combined with



swell which was running in the same direction as the wind. Until 0700 the vessel had been making good a speed of 20·0 kt. The following temperatures, positions and speeds were recorded. The lowest sea temperature of 13·9° was recorded at 0820.

Position	Time (GMT)	Speed (kt)	Sea Temp. (°C)
25° 11′N, 120° 53′E	0700		20·6
		18·75	
25° 23′N, 121° 09′E	0800		15·2
		20·00	
25° 33′N, 121° 29′E	0900		16·1
		21·20	
25° 44′N, 121° 49′E	1000		21·7

Note. The diagram has been constructed from the *Prometheus* data. The pattern of sea-surface temperature isotherms indicates the southward plunge of cold water due to cold currents and the northward reach of the main warm currents. At the time of the above report it is possible that a branch from the cold NE monsoon drift inshore of the China coast had set SE towards northern Taiwan and had there interrupted the convergence of the two warm currents, originating from the Kuro Shio, which set northwards on either side of Taiwan, resulting in the current pattern shown in the diagram.

HOLY CHILD CURRENT

off Peru and Ecuador

s.s. *Potosi.* Captain R. T. Riley. U.K. to Chile and return. Observer, Mr. C. G. G. Hawken, 2nd Officer.

January–March 1971. During the past three years between January and March the south-going Holy Child Current had been very much in evidence on the Peruvian coast, reaching as far south as 17°S. This current produced large amounts of discoloured water and a notable decrease in bird and fish life in the waters off the Peruvian coast.

However, in 1971 the Holy Child Current was not in evidence in that area and the predominantly north-going Peruvian Current remained off the coast of Peru with average sea-water temperatures and little discoloured water seen. Marine life was very abundant and in March off north Peru the ship passed hundreds of whales together with large schools of porpoises and flocks of sea-birds. Very large shoals of fish near the surface were heard and seen many times off the coasts of Peru and Chile; sometimes the waters were literally teeming with fish for miles. Off the Peruvian coast large flocks of birds were circling about the shoals, continually diving in and out of the water, and were clearly visible on the radar for as far as 10 miles.

As the vessel proceeded south the Peruvian Current was observed to increase in rate from about ½ kt off the coast of Peru to as much as 2½ kt at various places near Chile. Few whales were sighted south of Peru this voyage although seals were abundant off the Chilean coast and in the harbours.

The Holy Child Current seemed only to be prevalent up to about 3°S from 6°N and southerly sets were experienced, displacing the continuation or branch of the Peruvian Current off the coast of Ecuador. A sudden increase in sea temperature by 6 degc off southern Ecuador indicated clearly the disappearance of the cold, north-going Peruvian Current.

Many Manta Rays and a few Blue Marlins were sighted off the coast of south Ecuador and north Peru. Sharks were especially prevalent in January at the equator where many were seen swimming near the ship. Above-average sunshine was experienced in Peru and Chile. Large amounts of jellyfish with very vivid colours were seen at Callao Bay, Peru and many squids were seen at Valparaiso.

Note. The Holy Child Current is a regular feature of the current pattern from about January

to March southward of the Gulf of Panama, only as far as 3°s. Beyond this latitude the presence of this current is an occasional event occurring, on average, in about one year in four. Thus 1971, as the very interesting report from the *Potosi* reveals, has seen a return to more normal conditions off the Peruvian coast.

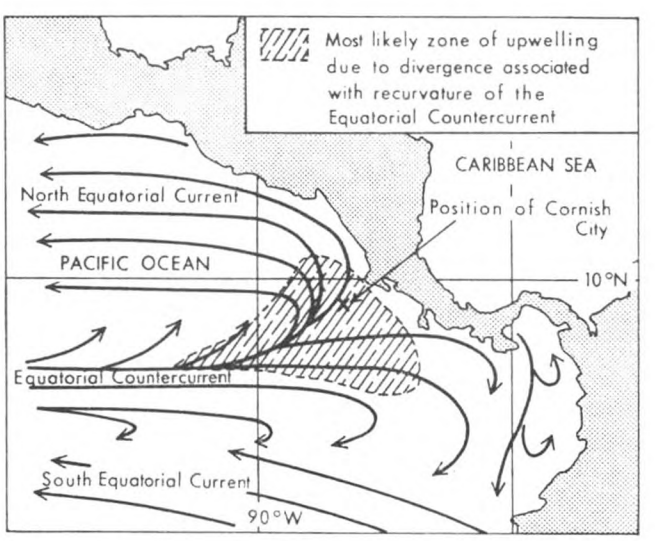
UNUSUALLY LOW SEA TEMPERATURE

Eastern Pacific Ocean

m.v. *Cornish City*. Captain D. L. G. Jones. Panama to Sakata, Japan. Observers, the Master and Mr. K. Milburn, 2nd Officer.

28th–29th January 1971. When the 1800 GMT observation was taken on the 28th the sea temperature had fallen 10 degC since 1200 to a cool 14·3°C. It then began to rise slowly until it was back to a normal 23° by 1200 on the 29th. Then it was found that the ship's speed had remained almost the same as on the previous day, suggesting that the cold water was not a current but rather due to upwelling as we were very close to Guardian Bank at the time.

Position of ship at 1800 on 28th: 9° 15′N, 87° 03′W.



Note 1. The extremely low sea-surface temperature recorded by the *Cornish City* (about 10 degC below the long-term mean for January) is undoubtedly due to upwelling. Three explanations for this phenomenon readily come to mind: one is due to off-shore winds from the north-east, another is due to the Guardian Bank, and the last is due to divergence of the Equatorial Counter-current as it bifurcates on approaching the west coast of Central America. The latter is thought to be the most likely cause (see diagram). The indicated area of upwelling coincides with an area of cold water on charts of minimum sea-surface temperature so it can by no means be considered rare. However, these charts show a temperature difference of only 3 degC from the long-term mean. To account for a 10 degC negative anomaly the upwelling must have been particularly active. This, in turn, can most easily be explained by a temporary 'surge' in the rate of the counter-current over its eastern part.

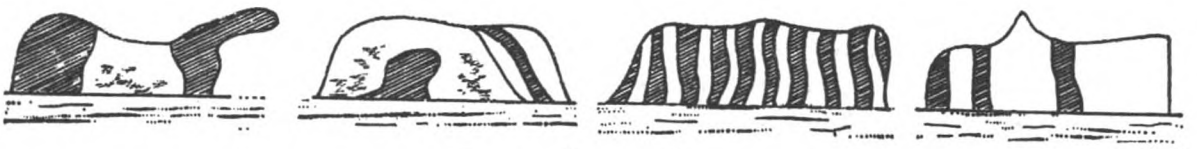
Note 2. The *Cornish City* is a Canadian Selected Ship.

BLACK AND WHITE ICEBERGS

Southern Ocean

R.R.S. *John Biscoe*. Captain M. J. Cole. Argentine Islands to Port Stanley via Signy Island. Observers, Mr. A. R. Binder, 3rd Officer and all other officers.

22nd March 1971. Between 1200 and 1915 GMT, while the vessel was on passage from the Bransfield Strait to Signy Island in the South Orkneys, a number of distinctly coloured icebergs were observed. During the period approx. 180 bergs were seen, a dozen of which claimed special attention because of their apparent composition of two types of ice. In these particular cases a portion (or portions) of



Scale 1" = 100' (approx.)

the bergs presented a black or translucent greenish-black appearance, as opposed to the normal white colour. The edges of the portions were clearly defined but the structure of the bergs as a whole gave no indication as to why the two differing types of ice should be present; the dividing line itself bore no relation to any physical differences within the bergs.

Some of the bergs were halved black/white with large areas of each, whereas others were composed of many alternating bands. One berg in particular, approx. 100 yd long, exhibited about 20 alternating bands spaced at fairly regular intervals. On some of the bergs the white ice was discoloured and appeared to be carrying a brown sediment, but this did not seem to be connected in any way with the black ice. All of the affected bergs were thought to be inclined at 90° to the position in which they were originally formed and the layers of ice were therefore vertical or near vertical.

Position of ship at 1200: 60° 25′S, 48° 05′W.
Position of ship at 1915: 60° 42′S, 45° 54′W.

Note. Dr. C. W. M. Swithinbank of the Scott Polar Research Institute, Cambridge, comments:

"I have done no work on black icebergs and I do not know anyone who has, though they are not very uncommon and there are many reports of such sightings in the literature. Samples held in the hand have been reported to consist of clear bubble-free ice, providing a conspicuous contrast with the white bubbly ice of which most Antarctic bergs are made. Until someone takes home a substantial and representative piece and subjects it to chemical analysis (organic and inorganic) all suggested explanations are no more than guesses.

"I have two alternative guesses. The first is that the black ice represents what was formerly a layer in an ice shelf or iceberg tongue that became soaked with sea water and then froze. This would account for the clean ice above and below the black ice, since brine-soaked layers are believed to be of only limited thickness. The icebergs calved from the ice shelf have later capsized, so that the layer of black ice may be at any angle.

"The alternative is that the black ice represents what was formerly water at the bottom of the ice sheet. This would explain an occasional association of rocks and rock flour with the black ice, for the water refreezes before the ice reaches the edge of the ice sheet. The fact that there is white ice not only above but also below the black ice would then have to be explained by the refrozen layer overriding more stagnant ice at the edge of the ice sheet. This is known to occur wherever such a process can readily be identified, that is to say where the ice sheet terminates on land."

BIRDS

Eastern North Pacific

m.v. *Cornish City*. Captain D. L. G. Jones. Panama to Sakata, Japan. Observer, Mr. K. Milburn, 2nd Officer.

1st February 1971. At 2230 GMT a group of about 100–150 birds which looked like storm petrels (brownish back and wings with white underparts, about the size of a common tern) were very busy feeding on small fish. This was made possible for them by some larger fish which were chasing the small ones. As the fish broke surface the birds swooped down and caught them, scooping them up without having to dive for them. This was the same method as used by the gulls in Cornwall (where I live) to scoop up pilchards when they are chased by bass.

Position of ship: 16° 15′N, 111° 04′W.

Note. The *Cornish City* is a Canadian Selected Ship.

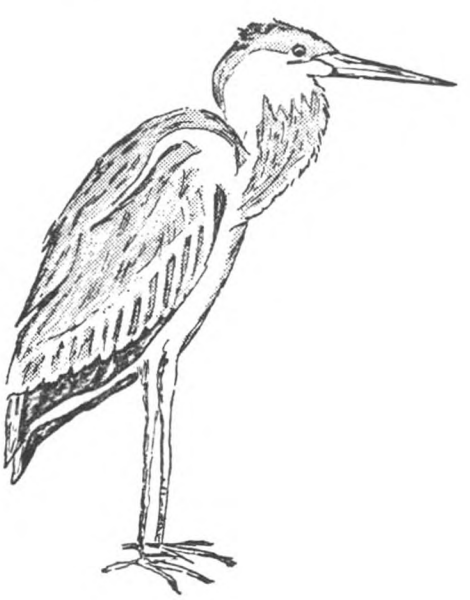
off Senegal

m.v. *Rievaulx*. Captain D. Fullwood. Glasgow to Monrovia. Observers, the Master, Mr. S. Brown, Chief Officer, Mr. D. Knight and Mr. N. Miller, Cadets, and ship's company.

9th March 1971. At approx. 1800 GMT this bird landed by way of No. 2 hatch and stood for about 4–5 min upright, as in the sketch, before changing to a fore/aft position. The head, for the most part, was white with a distinct black streak on the back and the white neck had slight dove-grey markings and small black marks on the throat. The colouring of the beak was of a light yellow ochre merging to grey on the upper part. The outer wing feathers were unusual in that the foremost one was black and the rest grey, but somewhat markedly singular. Beneath its grey wings it seemed to have a second layer of black feathers which went down to its short tail feathers.

When in flight the bird had a wing span of about 3½ ft and the lower throat and sternum typical of a heron. It also held its legs and feet in an extended position, protruding out from under the tail feathers. It stood about 2½ ft high in a relaxed position with its long neck tucked in flush with the body. (It was last seen at about 2300.)

Position of ship: 14° 35′N, 18° 03′W.



Note. Captain N. B. J. Stapleton of the Royal Naval Birdwatching Society comments:

"From the excellent description and sketch the bird has been identified as a Grey Heron (*Ardea cinerea*). This bird breeds in North Africa and has been identified on previous occasions by ships at sea on the same route."

Eastern Sea

m.v. *Glenfinlas*. Captain G. W. Povey. Kobe to Hong Kong. Observer, Mr. J. C. Goble, 2nd Officer.

27th March 1971. At 1800 GMT a small bird, about 9 inches over all and closely resembling a pied wagtail, was aboard the vessel and making several forays into the bridge. Being of an inquisitive nature, it was also found behind the chart table. When forcibly evicted, in order to facilitate navigation of the vessel, it took up station on and around the foredeck. The vessel was more than 200 miles north of Taiwan and 300 miles west of Okinawa at the time. The unusual perseverance of the bird in seeking human company is thought noteworthy.

Position of ship: 26° 49′N, 123° 25′E.

FISH

Caribbean Sea

m.v. *Otaio*. Captain R. B. Hood. Curaçao to Liverpool.

26th February 1971. When the vessel was off Roche Bluff, Montserrat Island, very fast-moving fish were sighted on the port quarter, occasionally breaking the water with their dorsal fins. As they came abeam and within a cable of the ship they could be seen quite easily in the very clear water and were identified as the dolphin fish (*Coryphaena hippurus*)—not the mammal dolphin—chasing flying fish at an amazingly high speed. Through binoculars one was seen to overtake a flying fish as he touched the surface, take that one then turn sharply to port through 90°, accelerate rapidly and chase another flying fish which immediately broke the surface in an effort to escape. The dolphin overtook this one, catching him in mid-air.

The whole operation lasted only a minute or two and seemed to involve three of the dolphins but their speed was so great that it was difficult to follow all the details of their movements and did not allow time for cameras to be brought to the scene.

Position of ship: 16° 41′N, 62° 08′W.

Note. Mr. G. Palmer of the Fish Section, Department of Zoology, Natural History Museum, comments:

"The eye-witness account of the manœuvrability and agility of the dolphin fish (*Coryphaena*) in chasing and catching flying-fish is very interesting to have."

MARINE LIFE

North Pacific Ocean

m.v. *W. C. Van Horne*. Captain D. L. Burt. Vancouver, B.C. to Fukuyama, Japan. Observers, Mr. P. Atkinson, Chief Officer, Mr. D. M. Shaw, 3rd Officer, Mr. D. C. Wright, Engineer Cadet, Mrs. V. A. Shaw and Mrs. A. McQuire, Supernumeraries.

27th January 1971. Shortly after reading about *Velella* in the article by Miss A. M. Clark in *The Marine Observer* [April 1970] it was noticed that a large number of these creatures were lying on the main deck the morning following a night of strong winds and rough seas. They were readily identifiable as *Velella* ['by-the-wind sailor'] from the description in Miss Clark's article and also from various other reported sightings from ships.

Specimen types found were transparent with a deep bluish-purple hue. The specimens collected had been lying on the deck for an undetermined period, both in sunlight and in shade. A deliberate pull was necessary to lift them from the deck where they had stuck quite firmly. When they were finally lifted a bluish-purple, sticky jelly was left deposited on the deck. The largest sighted measured approx. 2½ inches in length, 1 inch in breadth, with a 'sail' approx. ½ to 1 inch in height and generally oval-shaped.

During the whole forenoon watch the vessel steamed through a continuous stream of *Velella*, although when contact was first made it is impossible to say but presumably during the previous night when the wind was s'ly, force 6, moderating by daybreak to SSE, force 2. During this period the swell had been moderate SW–S'ly, approx. 10 to 12 ft in height. Course 230°T at 13 kt.

Position of ship at 1200 SMT on 27th: 37° 51′N, 146° 04′W.

13th March 1971. Vancouver, B.C. to Nagoya, Japan. Observer, Mr. P. Atkinson, Chief Officer.

At 0715 SMT, after sailing for over 2 hours since sunrise through waters strewn with many large shoals of *Velella*, brown streaks of what appeared to be the residue from tank-cleaning were observed lying in a NW/SE direction. On closer examination, these turned out to be concentrations of very small *Velella* with larger specimens

amongst them. The whole surface of the sea in the area seemed to be 'standing room only' for these animals. Wind at time of observation NNW, force 2.

Position of ship: 32° 39′N, 177° 29′E.

Note. The *W. C. Van Horne* is a Canadian Selected Ship.

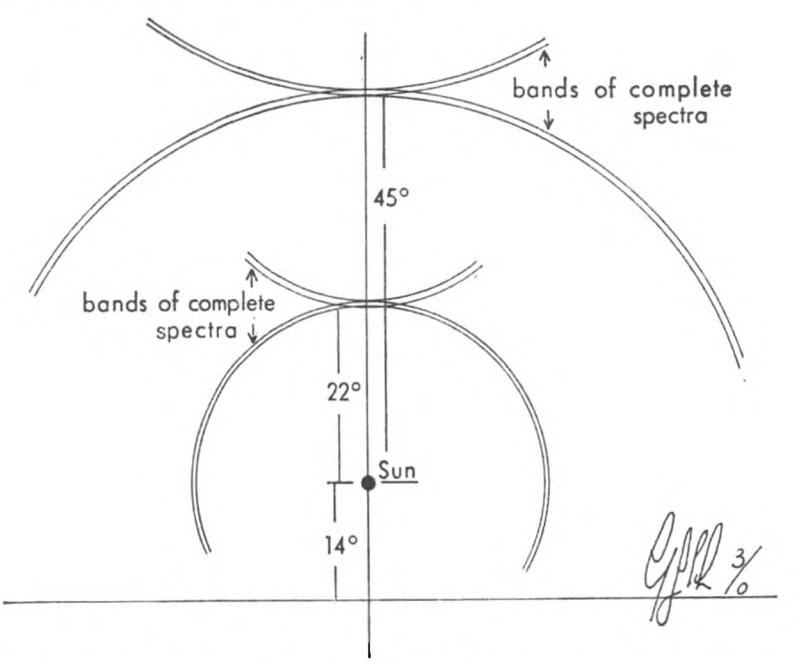
SOLAR HALO COMPLEX

Eastern North Atlantic

m.v. *Texaco Gloucester*. Captain R. C. White. Port Gentil to Las Palmas. Observers, the Master, Mr. G. J. P. Lang, 3rd Officer and Mr. D. H. O'Neill, Radio Officer.

3rd January 1971. At 0815 GMT, about one hour after sunrise, the sun was covered and almost obscured by a veil of Cs cloud when this halo complex was observed (see sketch). The sun's altitude was 14°. The inner halo was at a radius of 22° around the sun and the outer halo at a radius of 45°. The 'reverse' haloes merged with their parent, whose size they resembled almost exactly, at the vertical extremity of the parent halo. The haloes took the form of bands of complete spectra which gradually faded away over a period of 30 min. The haloes were seen to be complete rings although parts were obscured by cloud from time to time. Air temp. 26·9°C, wet bulb 25·1°. Cloud, $\frac{7}{8}$ Cs, $\frac{1}{8}$ Fc.

Position of ship (approx.): 05° 22′N, 13° 52′W.



Note. The 'reverse' halo to the outer halo is assumed to be the upper contact arc and not the circumzenithal arc whose brilliant colouring would surely have drawn special comment.

AURORA

The following notes have been received from Mrs. Mary Hallissey of the Aurora Survey:

"We list here briefly reports of aurora received at the Balfour Stewart Auroral Laboratory of the University of Edinburgh from British ships during January, February and March 1971.

"The observations listed, it will be noted, are, with two exceptions, from ships at high latitudes, so that the large number and high quality of the reports, written and sketched, are rather an indication of cloudless conditions than of exceptional geomagnetic activity. Periods of greater activity when those at lower latitudes were able to share the viewing occurred 19th/21st, 27th–31st January, 15th/16th, 23rd–27th February, 24th/25th and 30th/31st March. Communications were noticeably affected at these times. The observation from the southern hemisphere on 30th January was recorded at one of those now rare periods of sunspot activity. The ship, m.v. *Manapouri*, was in cis-auroral latitudes, as was the s.s.*Sunek* on 26th March,

when sailing near the British Columbian coast at the time when a short-lived sudden upsurge of activity produced the classic-type display recorded and sketched there.

"The Weather Ships as usual figure largely in the list. The sketch by Mr. Barnes of O.W.S. *Weather Surveyor*, depicting the multifarious auroral forms visible at 2045 GMT on 25th February makes one grateful that the solar particle collision processes involved should result in such visible magnificence rather than in some form harmful to (earth-bound) man, and we continue to speculate with awe over the intensity of natural rays when we read that artificially created auroras are difficult to detect in less than optimum conditions. Very varied, however, is the eye of the beholder. The excellent and very interesting reports from observers aboard O.W.S. *Weather Monitor* of aurora during January include such practical descriptions as "motheaten patches", "like looking into lighted Princes Street Gardens bandstand", and a patch "like orographic stratus constantly heaving like something from Quatermass!". Fascinated by the amount of detail the observers managed to get down, it was with some relief we read that a tape recorder had been used. The observer in m.t. *Northern Reward* on 15th/16th February admitted defeat when trying to record the continuously changing forms of the "finest and most brilliant display" he has observed.

"These reports all serve to confirm that even at this period of diminishing solar activity, in the region of the auroral zone, particularly around the equinox, auroral displays continue to be a fascinating spectacle. We thank you all for keeping us informed."

DATE (1970–71)	SHIP	GEOGRAPHIC POSITION		Λ	Φ	I	TIME (GMT)	FORMS
14th Sept.	*Northern Reward*	66°55′N	16°48′W	080	72	+77	2345–0012	HA
27th Oct.	*Northern Reward*	66°30′N	13°46′W	080	71	+76	2200–0030	P
2nd Jan.	*Weather Adviser*	59°04′N	18°48′W	070	65	+72	0700, 0800	N
3rd	*Weather Adviser*	59°11′N	18°55′W	070	65	+72	0100	N
							0400–0600	RB, N
14th	*Weather Monitor*	61°58′N	32°54′W	060	70	+76	0050–0600	HB, RR
	Miranda	66°36′N	23°35′W	070	73	+77	2045–2100	RB, RR
							2218	RR
15th	*Miranda*	66°25′N	23°30′W	070	73	+77	2250	N
17th	*Weather Monitor*	61°54′N	33°00′W	060	70	+76	0001	N
	Miranda	66°50′N	23°50′W	070	73	+77	1940–2100	N
	Ripon	68°36′N	13°40′E	110	67	+77	2018–2140	HA, RA, RR
18th	*Weather Monitor*	61°52′N	33°23′W	060	70	+76	2135–0200	HB, RB, RR, N
19th	*Weather Monitor*	61°59′N	32°50′W	060	70	+76	2145–0100	HA, HB, RB, SA, P
	Weather Surveyor	59°03′N	18°34′W	070	65	+72	2240–0400	HA, P, N
20th	*Weather Monitor*	62°00′N	32°51′W	060	70	+76	0245–0500	HB, RR, P, V, N
	Miranda	66°18′N	23°05′W	070	72	+77	0545	RR
	Weather Monitor	62°14′N	33°02′W	060	70	+76	2150–0300	HB, RR, V, N
	Weather Surveyor	59°01′N	18°49′W	070	65	+72	2337–0300	HB
21st	*Miranda*	66°30′N	23°50′W	070	73	+77	0245	RR
	Miranda	66°30′N	24°25′W	070	73	+77	2050	HB
	Weather Monitor	62°12′N	32°22′W	060	70	+76	2145–2300	HB, N
	Weather Surveyor	59°04′N	18°20′W	070	65	+72	2240–0600	HB, RB, N
23rd	*Weather Monitor*	62°07′N	32°12′W	060	70	+76	2045–2100	N
	Weather Surveyor	59°12′N	18°49′W	070	65	+72	2140	RB, RR
24th	*Weather Monitor*	61°36′N	32°39′W	060	70	+76	2300–0200	All forms
	Weather Surveyor	59°15′N	18°50′W	070	65	+72	2310–0100	HB
25th	*Weather Monitor*	61°39′N	32°45′W	060	70	+76	0600	HB
26th	*Weather Monitor*	62°01′N	32°41′W	060	70	+76	0345–0420	HB
							0800	N
27th	*Weather Surveyor*	59°09′N	18°34′W	070	65	+72	2035–0700	HB, RA, RB, RR, N
	Weather Monitor	61°51′N	33°07′W	060	70	+76	2345–0200	RR, P, N
28th	*Weather Monitor*	61°52′N	33°13′W	060	70	+76	0440–0800	RB, P, N
	Weather Surveyor	58°57′N	18°26′W	070	65	+72	1945–0200	HA, HB, RR, P, N
	Weather Monitor	61°54′N	33°15′W	060	70	+76	2040–0500	All forms
29th	*Miranda*	66°18′N	24°00′W	070	73	+77	2050	HA, RB
30th	*Weather Monitor*	61°48′N	33°43′W	060	70	+76	0245–0255	HB
	Weather Surveyor	59°06′N	18°53′W	070	65	+72	0445	N
	Manapouri	46°00′S	170°00′E	250	−51	−71	1000–1040	RR, N
	Weather Surveyor	59°05′N	18°55′W	070	65	+72	2145–0300	HA, HB, N
12th Feb.	*Weather Adviser*	59°02′N	19°10′W	070	65	+72	2150	N
14th	*Weather Reporter*	62°04′N	33°22′W	060	70	+76	2350–0100	RB
15th	*Northern Reward*	68°35′N	12°24′E	110	67	+77	1715–2230	All forms
	Weather Reporter	61°59′N	33°16′W	060	70	+76	2115–0300	HB, RA, RB, P, V
	Weather Adviser	59°00′N	18°40′W	070	65	+72	2150	N
16th	*Northern Reward*	68°35′N	12°24′E	110	67	+77	1700–0100	All forms
	Weather Reporter	62°06′N	33°38′W	060	70	+76	2045–0100	HB, RB, P, V, N
17th	*Northern Reward*	68°35′N	12°24′E	110	67	+77	1800–2300	All forms
	Weather Reporter	61°48′N	33° 00′W	060	70	+76	2350–0200	N
18th	*Northern Reward*	68°35′N	12° 24′E	110	67	+77	1800–2300	All forms
	Miranda	64°05′N	22°00′W	070	70	+76	2150–2200	RB
19th	*Weather Reporter*	61°58′N	32°44′W	060	70	+76	0145–0430	RA, RB
20th	*Weather Adviser*	59°00′N	19°10′W	070	65	+72	0215–0500	RR, N
	Weather Reporter	62°02′N	33°00′W	060	70	+76	0330–0340	RA
	Weather Reporter	62°01′N	32°30′W	060	70	+72	2300–0200	HB, N

Date (1971)	Ship	Geographic Position		Λ	Φ	I	Time (GMT)	Forms
21st Feb.	*Northern Reward*	70°22′N	17°05′E	120	68	+78	1800–0300	All forms
23rd	*Weather Reporter*	62°08′N	33°28′W	060	70	+76	0145	N
	Weather Adviser	58°54′N	19°00′W	070	65	+72	2050–2220	N
24th	*Northern Reward*	67°50′N	11°30′E	110	67	+77	2100–0130	N
25th	*Weather Adviser*	59°08′N	19°50′W	070	65	+72	0150, 0450	N
	Weather Surveyor	60°05′N	23°50′W	070	67	+74	2015–0430	All forms
	Weather Adviser	58°52′N	19°00′W	070	65	+72	2100–0600	RB, RR, N
	Weather Reporter	61°24′N	32°40′W	060	70	+76	2205	RB, RR, P
26th	*Weather Reporter*	61°25′N	32°40′W	060	70	+76	0255–0430	RB, RR, P, V
28th	*Miranda*	65°25′N	24°40′W	070	72	+77	0100–0130	HB, RB, RR
3rd Mar.	*Weather Surveyor*	61°55′N	32°50′W	060	70	+76	0045–0200	HA, HB, RA
4th	*Weather Surveyor*	61°43′N	33°15′W	060	70	+76	0048–0300	HA, HB, RR
10th	*Weather Surveyor*	62°00′N	32°55′W	060	70	+76	0045–0210	RR
12th	*Weather Monitor*	58°35′N	19°25′W	070	65	+72	2020–2200	RB, RR
13th	*Northern Reward*	68°10′N	11°00′E	110	67	+77	1800–2240	All forms
14th	*Northern Reward*	68°10′N	10°35′E	110	67	+77	2000–0200	RR, P
	Weather Surveyor	62°10′N	33°15′W	060	70	+76	2135–2153	RA, RR, V
	Weather Monitor	58°40′N	18°20′W	070	65	+72	2245	N
	Weather Surveyor	61°08′N	33°16′W	060	70	+76	2315	N
15th	*Weather Surveyor*	61°45′N	33°27′W	060	70	+76	2145, 2345	N
17th	*Weather Surveyor*	62°00′N	32°25′W	060	70	+76	2345	N
18th	*Weather Surveyor*	62°08′N	32°27′W	060	70	+76	0240–0500	RB, N
19th	*Weather Adviser*	56°40′N	11°30′W	080	61	+70	2100	N
	Weather Surveyor	61°57′N	32°35′W	060	70	+76	2142–0600	HA, HB, RA, RB, P, V
	Weather Monitor	59°00′N	18°30′W	070	65	+72	2145–0600	HA, RA, RB, N
20th	*Weather Adviser*	57°00′N	12°20′W	070	62	+71	0100–0300	N
24th	*Weather Surveyor*	58°55′N	19°00′W	070	65	+72	0100	N
	Weather Monitor	59°00′N	18°55′W	070	65	+72	2300–0200	N
26th	*Weather Adviser*	62°07′N	33°21′W	060	70	+76	0345–0430	RR, N
	Sunek	52°10′N	128°40′W	290	56	+73	0700–0800	HA, RB, N
27th	*Weather Adviser*	62°11′N	33°25′W	060	70	+76	0001–0100	N
							0450–0600	HB
28th	*Weather Monitor*	59°00′N	18°00′W	070	64	+72	0001	N

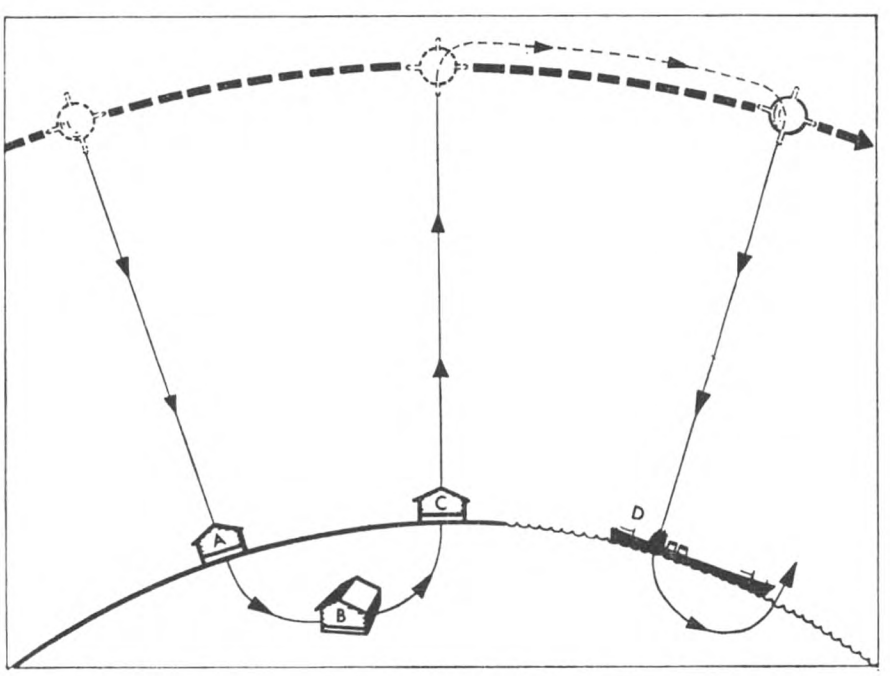
Key: Λ = geomagnetic longitude; Φ = geomagnetic latitude; I = inclination; HA = homogeneous arc; HB = homogeneous band; RA = rayed arc; RB = rayed band; R(R) = ray(s); P = Patch; V = Veil; S = striated; N = unidentified auroral form.

551.507.362.2:629.12

Meteorological Benefits from Satellite Navigation

By Captain F. N. Curphey
(Master, m.v. *Prometheus*)

The *Prometheus* sailed from the U.K. early in February 1971 on a voyage to the Far East, via the Cape, fitted with a Satellite Navigation system for evaluation purposes (see Fig. 1). Most people by now are fully acquainted with the technical information on how the system operates, so it is suffice to say that once conversant and familiar with the equipment it is simple to operate and there is no ambiguity in the position fix. No tables or special charts are necessary so the possibility of human error has been eliminated.



Master Station A receives satellite signals and measures Doppler effect during satellite transit; Master Station B's computer calculates satellite track; at C the revised track information is transmitted to satellite memory; at D the ship's equipment receives the continuously re-transmitted information from the satellite and calculates ship's positions automatically.

Fig. 1. The Satellite Navigation system.

After every satellite 'pass' the system will, independently and automatically, print out an accurate position fix and time once the programme has been fed into the computer and initiated by feeding into the teleprinter such local data as:

Day of the year (Julian)
GMT to within ± 15 minutes
Estimated latitude and longitude to within $\pm 3°$
Antenna height relative to the A.P.L. ellipsoid
(Applied Physics Laboratory, Johns Hopkins University)
Ship's speed and direction.

The system is also set to give an automatic 'print out' of the updated D.R. position every half-hour.

Residual numbers given after the print-out position give a gauge of the 'fix' quality, so that the navigator knows just how reliable the fix is; accuracy is very often to within 0·25 miles.

A tremendous asset is the world-wide coverage, no special shore stations being

required as four widely-spaced stations already set up on U.S. territory are continually tracking the satellites and injecting them with new data every 12 to 14 hours, positions being obtainable in any part of the world.

With five operational satellites in orbit, each between 400 and 700 miles high and circling the earth every 108 minutes, the approximate maximum transits possible are 22 at the Equator, 26 at latitude 30°, and 40 at latitude 60°. The majority of these transits will give a fix as a minimum of only three residuals are required and these are received every two minutes from the satellite; the higher the transit the larger the number of residuals received.

Coverage is good in practically all weathers; slight trouble with static interference in tropical-storm conditions was encountered but, with experience, we usually managed to shake this off. In areas such as the North Pacific where fog is prevalent at certain times of the year and lasts for days, the Indian Ocean during the SW monsoon when the horizon is hardly discernible, the Persian Gulf and Red Sea during sandstorms, winter in the North Atlantic, and many other areas in the world where, due to climatic conditions, positions are not obtainable by the traditional methods of navigation, the system with its frequent, accurate fixes will be an invaluable boon to the shipmaster.

Also, when sending out weather reports the advantages of having so many accurate positions throughout the day and night are inestimable, especially in typhoon and cyclone conditions when a true position is so valuable. The often unavoidable D.R. position given in storm conditions likely to persist for any length of time is more likely to vary considerably from the true.

With so many frequent positions being readily available the vessel's course made good can be plotted and compared with the course steered. A good assessment can be made of the prevailing current and course adjusted, thus saving distance. During the hours of darkness, when sights are not obtainable and out of range of visual bearings, with the satellite fixes a constant watch can be maintained of the effect of currents which is not possible otherwise. This is most pronounced in areas where currents are locally strong, e.g. off the southern coast of Madagascar, the Agulhas Current off Cape Columbine, South Africa and crossing from the Equatorial to the Guinea Current, running in opposite directions off West Africa, and of course the Kuro Shio in the southern approaches to Japan.

Although more difficult to ascertain accuracy on ocean passages, the currents recorded appear far more accurate than those worked from celestial sights.

In the very near future ships will, in all probability, be fitted with the Satellite Navigation system working in conjunction with the facsimile weather recorder and with this world-wide coverage the rewards of space exploration to mankind in general and seamen in particular will indeed be most beneficial.

551.507.22:597

A Rare Deep-sea Angler from Weather Station 'Alfa'

By D. H. Jones
(Institute for Marine Environmental Research, Craighall Road, Edinburgh)

At 1930 hours on 28th May 1971 at Station 'Alfa' (62°N, 33°W) Stuart Norwell, Chief Officer of O.W.S. *Weather Reporter*, noticed the brightly coloured body of a redfish drifting about 20 yards off the ship's port side. A further look showed that the redfish was, in fact, held in the mouth of another much larger fish, jet-black in colour. With the help of Boy Steward W. Gallacher, Chief Officer Norwell quickly inflated and launched a dinghy and set off in pursuit of the two fish which, by this time, were disappearing rapidly from sight as *Reporter* drifted away at about one knot. However, by dint of some hard rowing the fish were secured, towed back to the weather ship and hauled on board where considerable interest was aroused by the unusual appearance of the larger fish and the puzzling manner in which both fish had died. The condition of the two fish was surprisingly good and it was obvious that they had not been dead for long. It also became apparent that the redfish had not only caused the death of the larger fish, a Deep-Sea Angler, but had also been responsible for its own death. It had evidently swum into the mouth of the Angler with sufficient force to break through the gill arches and burst through the outer wall of the gill chamber, to become wedged there with its head emerging through the broken wall and with its tail still protruding from the Angler's mouth. The Angler has many sharp, backwardly pointing teeth in its jaws and the Redfish has many spines on its head, on its gill-covers and along its back, all of which must have prevented the fishes from separating themselves. In this way, locked together, they floated to the surface in the path of the drifting weather ship. Their weights and measurements are given in Table 1.

Table 1. Particulars of the two fish

	Weight	Total Length	Body Length
Angler	9·0 kg (approx. 20 lb)	148 cm (approx. 58 in)	62 cm (approx. 27 in)
Redfish	0·75 kg (approx. 26 oz)	39 cm (approx. 15 in)	32·5 cm (approx. 13 in)

Redfish (Latin name *Sebastes mentella*) weigh between 1 and 2 pounds and measure from 12 to 20 inches long and they are a familiar sight to the crew of weather ships on Station 'Alfa' because they are frequently caught there either for scientific research or for sport, but the Deep-Sea Angler (*Ceratias holboelli*) is sufficiently rare to be of special interest not only to them but to marine biologists and museum staffs in many parts of the world.

Deep-Sea Anglers are members of a group of fish that lives in the regions of the sea where light does not penetrate, where the temperature is low and constant and the pressure is high. Because of the difficult conditions of life in which the fish live they are modified and adapted in many ways. As a result they may appear very different from the more familiar, commercially-caught fish.

Many Angler fish are small, measuring no more than a few inches long, but the specimen caught at Station 'Alfa' belongs to one of the large species in which the females grow to a length of 2 feet or more, measured from the snout to the base of the tail, while the tail itself may add between 2 and 3 feet to the overall length. The development of the tail is in direct contrast to that of other fins (see Fig. 1 and photograph opposite page 25). There are no paired ventral fins and the pectoral fins are so

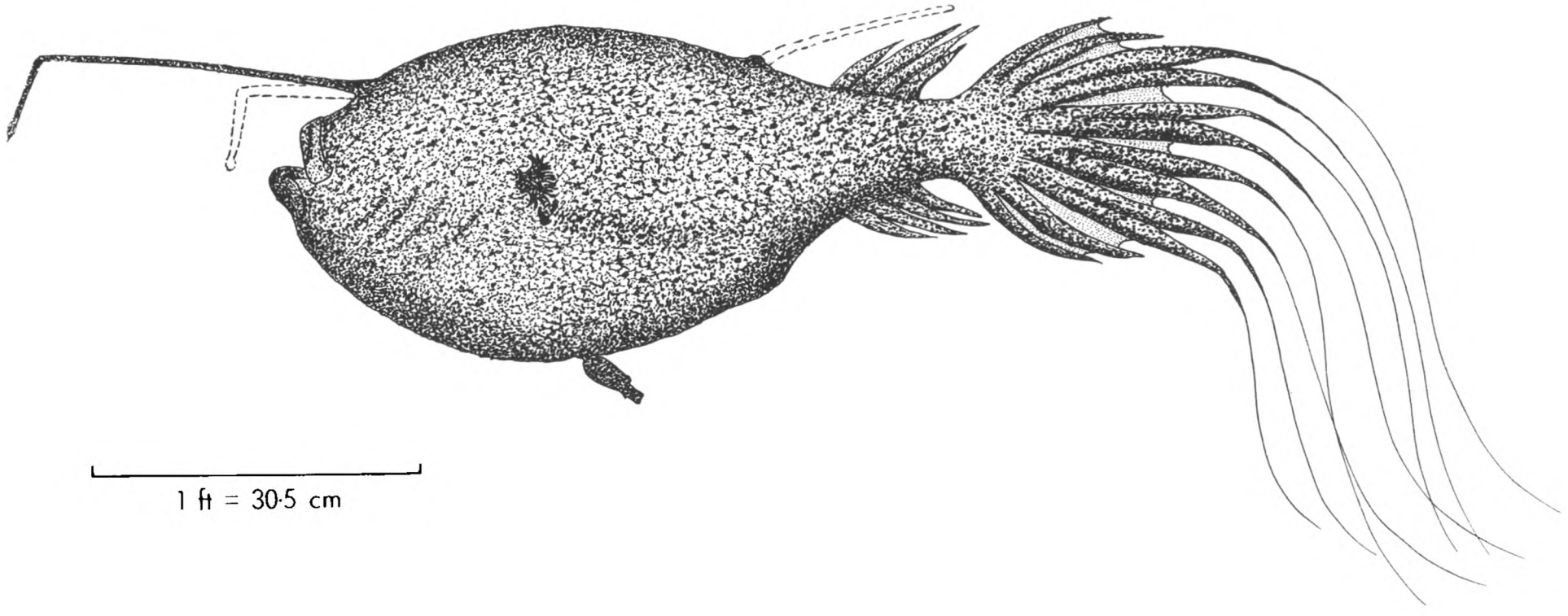
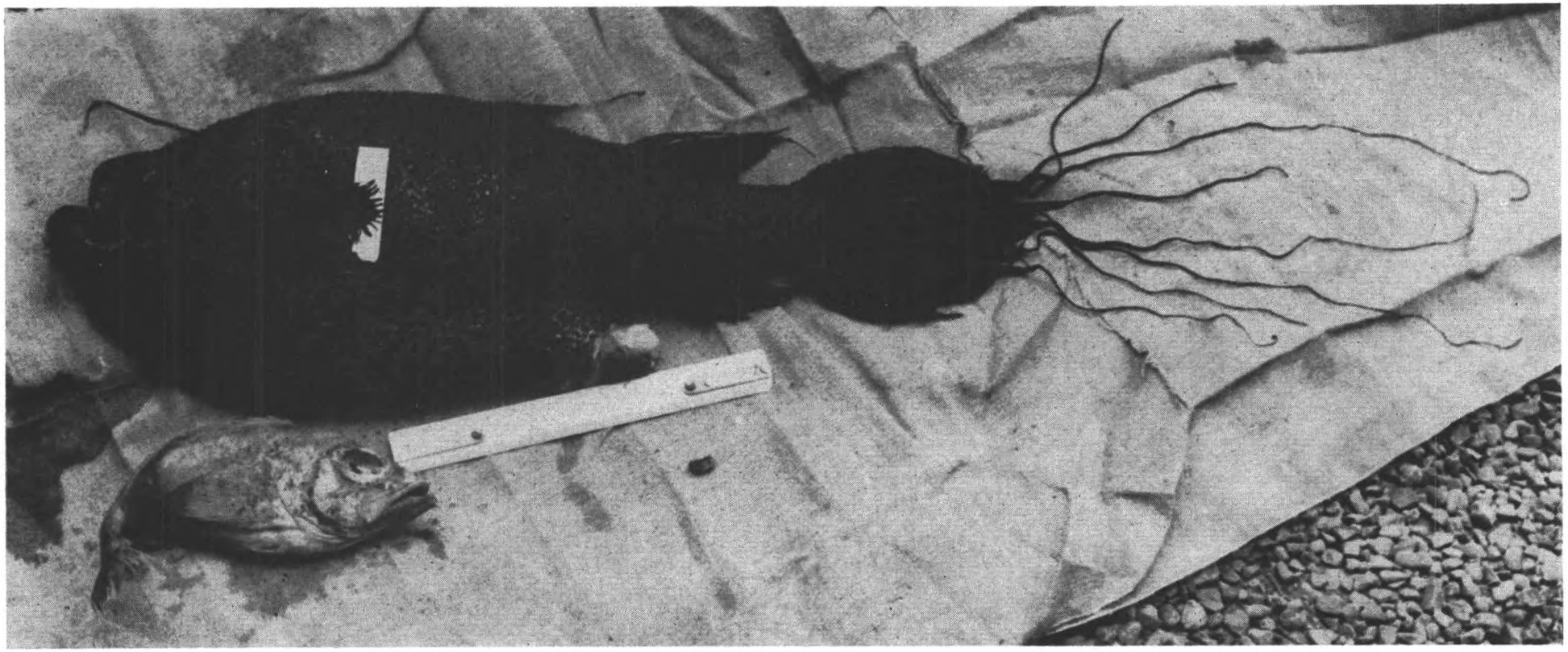


Fig. 1. Female Deep-sea Angler (*Ceratias holboelli*) **with 'fishing rod' advanced (solid black) and retracted (dotted lines). A parasitic dwarf male is attached to the underside of the female.**

(*Opposite page 24*)

(*Opposite page 25*)



The Deep-sea Angler Fish from Ocean Weather Station 'Alfa' with the Redfish that killed it.
A one-foot ruler lies below the Angler (*see* page 24).

much reduced that they can do little in the way of helping either propulsion or balance. In fact the fish seems ill-provided for fast swimming movement as, in addition, it has a very rough, spiny surface, the body being covered with strong, plate-like scales and it is not streamlined in any way. As females of this species become mature they also become blind so that they cannot find their prey by sight.

However, this disability is counteracted by the possession of what is the most intriguing adaptation of the Angler fish, the 'fishing rod' and 'lure', an apparatus which encourages the prey to come to the fish. Animal life in deep waters is very thinly scattered and finding sufficient food must be difficult for a poorly equipped hunter unless special methods are used. The apparatus which has developed during the evolution of Deep-Sea Anglers resembles very closely the rod, line and bait used by human anglers. The 'rod' is a bony structure lying partly beneath the skin in a groove along the middle of the back and partly outside the body above and forward of the head. At the front end there is a further piece of bone, hinged to the 'rod', which hangs down to form the 'line'. At the tip of the 'line' there is a bulb-like structure bearing filaments of skin which act as a lure. The whole apparatus is under the control of muscles and may be moved forwards and backwards through the groove in the back. When it is retracted the rear end of the rod emerges in front of the dorsal fin and protrudes, within its pocket of skin, for the equivalent distance that the front end is withdrawn (see dotted lines in Fig. 1).

The exact method used by the fish to capture food is not known for certain, but can be judged fairly accurately by comparison with studies on similar fish which have been watched in aquaria. The bulb or 'lure' of the angling apparatus in Deep-Sea Anglers bears luminous tissue and the light from this, which may be a continuous glow or a pattern of flashes, will attract certain animals close to the Angler. The 'lure' will be held well forward and then, as the prey approaches, will be slowly withdrawn, bringing the prey within reach of the Angler's upturned, large mouth. The method by which the Angler 'strikes' is not known but two examples of possible methods immediately become apparent from a knowledge of the structure of the fish. The mouth is large and connects, through the gill arches, with two capacious gill chambers. Each of these opens to the exterior by a small slit at the rear of the chamber, below the pectoral fins. The rapid opening of the mouth, the enlargement of the gill chambers by the extension of their flexible outside wall and the closing of the gill slits would cause a considerable pressure reduction in the mouth. The consequent inrush of water would carry the prey helplessly in to the mouth to be trapped and swallowed. Alternatively, the structure of the mouth and gill chambers, especially the small gill aperture, suggests a second possibility; that water may be drawn into the mouth and chambers and, by a contraction of the outer wall of the latter and the pressure provided by the large muscular tongue, water could be forced rapidly out of the gill slits and provide a form of 'jet propulsion' similar to that used by squids. This would propel the Angler forward and would enable it to engulf the prey in its large mouth.

If some behaviour similar to this took place in the waters under Station 'Alfa' it is possible to understand just how a large Deep-Sea Angler was 'run-down' by the smaller, fast-swimming redfish, which is, by its structure and shape, an obvious hunter of food. Attracted by the light or by the vibrations of the 'lure' the redfish went into the attack 'full steam ahead' and with the Angler opening its mouth to receive a tasty morsel, the resultant impact must have been like a head-on collision between a fast car and a stationary lorry.

Another unusual feature and a very specialized adaptation of Deep-Sea Anglers to their particular conditions of life is that male fish remain small in size and become parasites on the females (see Fig. 1). When a particular type of fish lives a solitary life instead of forming shoals the problem arises of how male and female fish can find each other at a suitable time to enable them to mate, reproduce and continue their particular species. To get over this problem the adolescent Deep-Sea Angler males attach themselves to a female whenever the opportunity arises, grip-

ping her skin with their teeth and remaining a passenger until both fish are sexually mature. The flesh of the two fish fuses at the point of attachment, the blood systems come to lie close to one another, just as in the placenta of a mother and baby, and food is transferred from the blood system of the female to that of the male. The latter retains an independent breathing system but other than this it depends entirely on the female and degenerates into little more than a sac of reproductive tissue. Unfortunately the Angler found on Station Alfa had no male fish attached to her, despite being fully grown and there were no signs that she had previously carried a male fish.

The capture and examination of the Deep-Sea Angler has been of considerable interest not only to marine biologists at the Oceanographic Laboratory but also to the staff of the Royal Scottish Museum, Edinburgh. The specimen has now been placed in the keeping of the museum staff who will prepare models of it which will be used in displays. Because it is apparently the most complete specimen ever found, it enabled us to learn more about the fish, its structure, its food and its parasites than was known previously. It is possible, especially in the case of rare species, to increase our knowledge significantly by the study of a single animal. For this reason we are extremely grateful to Chief Officer Norwell, Boy Steward W. Gallacher and the Captain and crew of the *Weather Reporter* for collecting and preserving this fish and for providing us with the opportunity to learn something new about an unusual and rarely-seen resident of the ocean depths.

551.507.2:551.509.317

The Value of Upper-air Observations from Merchant Ships

By T. H. Kirk, B.Sc.
(Chief Forecasting Adviser, Meteorological Office)

There is a long history of co-operation between the Merchant Navy and the Meteorological Office in the making of weather observations over the oceans. This co-operation started as long ago as the middle of the last century when the Meteorological Office, then a department of the Board of Trade, existed primarily for satisfying the needs of shipping. Since that time seamen have contributed weather observations on a voluntary basis and this service has become more highly organized and efficient during this century through the introduction of radio.

The early efforts at weather forecasting were based on the surface weather map; the movements of systems of isobars, the depressions and anticyclones, were plotted and the meteorologist based his forecast on the projected positions of these systems, the expected situation at a future time. For these relatively simple procedures the surface observations were sufficient and for a long time were the only observations available to the meteorologist although, even in those early times, the importance of getting observations from the upper air was realized.

Just as the Meteorological Office found itself, initially, geared to the requirements of shipping, so at a later stage it was called upon to satisfy the fast-growing requirements of aviation. The upper atmosphere, which had been sampled at an earlier time by instruments attached to kites, flown on piano wire, was now becoming accessible to observation by means of aircraft. Observations were chiefly of temperature and humidity and, for a time, regular aircraft ascents were made for this purpose, notably at Duxford and later at Mildenhall and Aldergrove. Forecasters became adept at using this information for local forecasting, particularly for aviation, but it was of little use for improving shipping forecasts.

A notable advance, beginning before World War II, was the adoption of the radiosonde as the primary means of securing reliable upper-air observations on a routine basis. The war-time demand and the subsequent post-war development of commercial aviation led to the establishment of large numbers of radiosonde stations, equipped for making observations not only of temperature and humidity but also of upper winds, by means of radar. The earlier wind observations, made by tracking small pilot balloons by theodolite until lost in cloud, were first supplemented by the new radar-wind observations and eventually almost completely replaced by them.

The use of weather observations in forecasting

The demands of aviation and the availability of upper-air observations soon revealed the extent to which the weather is three-dimensional in character. The early attempts at forecasting, based only on surface observations, were seen as very crude and simple efforts, effective only in the most straightforward circumstances.

The analysis of the atmosphere, in three dimensions, came progressively as aircraft flew at ever increasing altitudes. Their requirements led to the construction of weather charts at different levels. Since, in the making of radiosonde observations, the atmospheric pressure is measured directly and the geometric height (the altitude) is a derived value, upper-air charts are drawn at different pressure levels: in order of increasing height, 850 mb (about 5,000 feet), 700 mb (about 10,000 feet), 500 mb (about 18,000 feet), 300 mb (about 30,000 feet), 200 mb (about 40,000 feet), 100 mb (over 50,000 feet). On each chart, contour lines (lines of constant height) give a representation of wind direction and speed just as the isobars on a constant-level chart at the surface give a representation of surface wind speed and direction.

Centres of low contour height correspond with the depressions at the surface and areas of high contour height with the surface anticyclones. Experience with upper-air charts led to the development of rules whereby the influence of upper-air features on the surface pressure field could be determined. Forecasting became more sophisticated and more exacting as the forecaster had to think in four dimensions, three dimensions in space and a projection in time.

By the early 1940s it was becoming evident that the big surge of progress following the widespread use of upper-air observations would be dissipated unless new methods of forecasting could be found. The future of forecasting was soon seen to be closely linked to the development of electronic computers. To appreciate how the computer can play a fundamental part in weather forecasting it is necessary to look again, in a simple fashion, at the basic ideas behind the forecast.

When only surface observations were available, particular features of the pressure distribution such as lows, highs, or discontinuities (fronts) could be identified at specified times (the synoptic hours) and followed or tracked. The forecast skill consisted in the estimation of the future positions of these features. Experience brought rules whereby the crude extrapolation process could be modified with advantage. The use of upper-air observations enabled the influence of the upper atmosphere to be estimated—the so-called 'development' which was responsible for modifying the simple straightforward behaviour that was consistent with extrapolation. More subjective rules were added to the armoury of the forecaster but the fundamental procedures were still subject not only to intrinsic errors but also to errors due to lack of individual skill and insight on the part of the forecaster.

In what has come to be called numerical weather prediction (NWP) a different approach is adopted. The atmosphere is conceived as a physical system, subject to physical laws, in effect Newton's laws and the laws of thermodynamics applied to the motion of a fluid. These laws are well known and are capable of describing the future behaviour of the fluid provided that the state of the fluid is known completely at any initial time. This initial state is what the forecaster means when he speaks of an 'analysis', although the term is usually applied only to a particular surface (for example, an isobaric surface at 500 mb). The problem of depicting the complexities of the atmosphere in simple terms leads to the essential concept of a 'model'. For the present purposes, a model is a simplified version of the atmosphere which is describable by relatively simple mathematical equations. Solving the equations, with the aid of an electronic computer, leads to a determination of the state of the atmosphere at a future time—a forecast or 'prognosis'. As the speed and capacity of computers have increased, so have more sophisticated numerical models been introduced. For details of recent progress readers may consult an account by Bushby.[1]

It can now be appreciated that the accuracy of a forecast must depend on our ability to specify, as accurately as possible, the state of the atmosphere at some particular time (the synoptic hour). This has always been so, whether forecasts have been made in the traditional fashion by using a time sequence of observations or are made by using numerical methods. The use of numerical methods, however, makes the determination of the initial state more important or critical.

Additionally, it is found that forecasts for periods appreciably over 24 hours require the analysis of observations on a hemispheric scale. Not only must the weather be conceived as three-dimensional in character but it must be regarded as 'global' or at least 'hemispheric'. Thus we are now concerned largely with hemispheric models and the forecaster requires observations as never before, observations not only over the continents but also over the oceans. An important point to remember is that the NWP models require upper-air observations and not just surface observations.

International organization and co-operation

The meteorologist has always led the way in international co-operation. Driven

by mutual need, meteorologists of all nations have for years been exchanging their weather observations. Before World War II the work of standardizing methods of observation, achieving agreement on code forms and methods of transmitting the observations was under the control of the International Meteorological Organization (IMO), a free association of meteorologists. After the war, the World Meteorological Organization (WMO) was formed to replace the IMO. An important difference is that the WMO, as an agency of the United Nations, is now backed by the Governments of the Member nations.

In 1967 the WMO 5th Congress adopted the concept of 'World Weather Watch', an improved world meteorological system designed to provide for the efficient development of meteorology and hence for improved benefits for mankind. Quoting from the original document:

> The purpose of the World Weather Watch is to enable the unprecedented opportunities which now present themselves for progress in the atmospheric sciences to be seized and to enable all Members to derive the full benefits from the improved meteorological services which such progress will make possible. Such improvements will have a profound impact on the agriculture, commerce and industry of all nations and will permit more accurate and timely warnings of severe storms and other weather hazards for the protection of life and property. It will further the safety and efficiency of international air and sea transportation and provide essential support to nations in the management of water resources and food production.

The World Weather Watch provides for three major sub-systems, which are:

(*a*) the Global Observing System, comprising the observational networks and other observational facilities.
(*b*) the Global Data Processing System, providing for the processing of observational data and for storage and retrieval of data.
(*c*) the Global Telecommunication System, providing facilities for the rapid exchange of both observations and processed data.

The Global Observing System comprises:

(*i*) land and ocean networks of surface observations.
(*ii*) land networks of radiosonde stations.
(*iii*) fixed ocean stations (weather ships).
(*iv*) aircraft reports.
(*v*) meteorological satellites.
(*vi*) mobile ships.

Of all these observations the most valuable ones, of direct and immediate use in numerical prediction models, are the upper-air reports from land stations, from weather ships and, more recently, from mobile ships. At present, strenuous efforts are being made to use the observations from meteorological satellites in the operational prediction models. Their optimum value, however, is dependent on the availability of a minimum number of orthodox radiosonde observations in addition. Over the oceans these can be made available only from weather ships and mobile ships (merchant ships). For many reasons it is impracticable to increase appreciably the number of weather ships and hence the importance of radiosonde observations from merchant ships becomes apparent.

The WWW plan for 1968–71 set a target of 100 mobile ships to be equipped for making radiosonde observations. By the end of 1970 there were 34 such ships and the number was expected to increase to 68 by the end of 1971.

Upper-air observations from merchant ships

The call for upper-air observations to be made from merchant ships is relatively new but the possibility has been envisaged by meteorologists for some years past. Hitherto, however, there have been practical difficulties in organizing an activity of this kind. Some idea of these difficulties and the methods by which they are being

overcome may be obtained from an article by W. J. Cox.[2] At present two ships, the *Sugar Exporter* and the *Sugar Producer*, are co-operating in this work. The plans of the Meteorological Office call for an early expansion to a total of ten ships.

It is important that meteorologists on board these ships should be employed to full advantage. In addition to the radiosonde ascents, it is desirable to have observations of the upper winds. Techniques are being developed whereby upper winds can be measured from a mobile ship by the use of navigational aids, such as Loran C and Omega, for measuring the displacement of a radiosonde launched from the ship. According to present plans, the Omega system will be available for use on a world wide basis by 1973; Loran C, however, has limitations in that it does not cover the tropics and most of the southern hemisphere.

The meteorologist is interested primarily in equipping ships that are likely to traverse the data-sparse areas (see Fig. 1) not only in the northern hemisphere, but particularly in the tropics and the southern hemisphere.

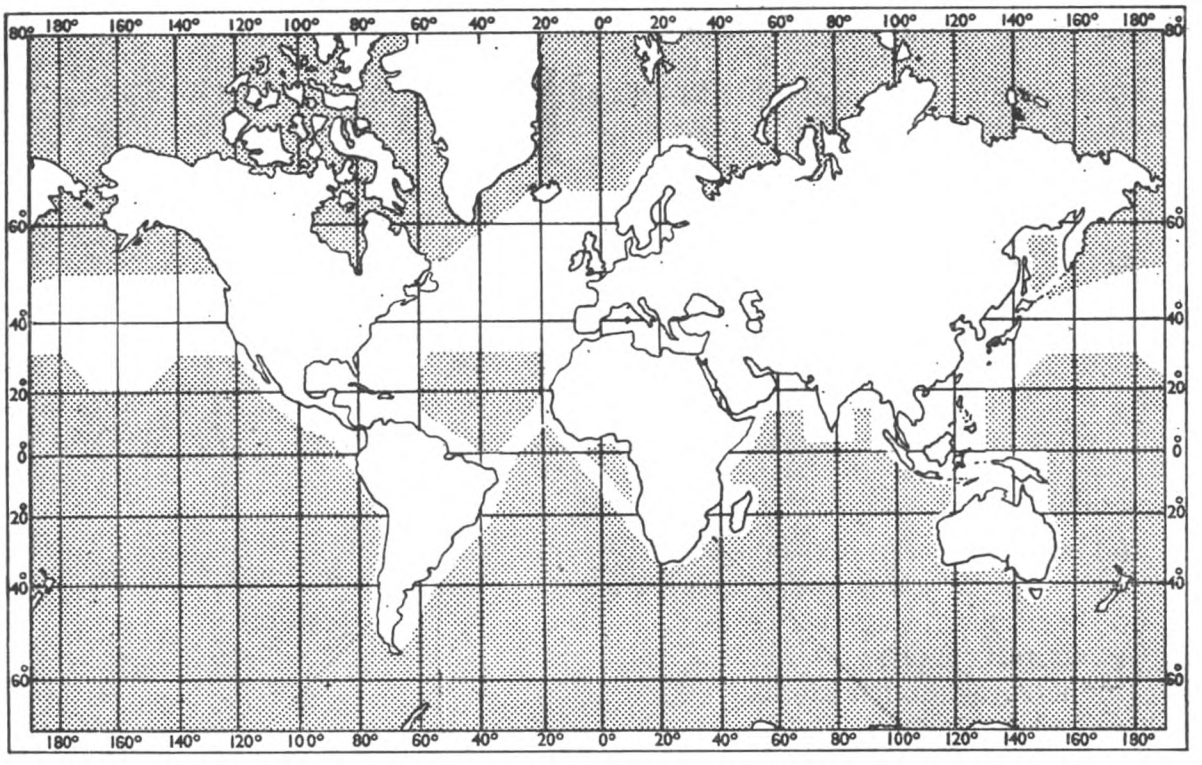


Fig. 1. The shaded areas are those in which shipping is sparse.

The future of weather forecasting

The World Weather Watch provides the over-all plan for systematic advances in meteorology and in weather forecasting. Observations from merchant ships, and in particular upper-air observations, will play an important part in realizing the full advantages to be gained. There can be no impressive improvements in forecasting unless improved networks of observations become available and it is unfortunately a fact that, even now, observations are completely lacking over wide expanses of the oceans, particularly in the tropics and in the southern hemisphere.

In the future the weather satellite must play an increasing part in providing suitable observations. Present needs, however, call for orthodox upper-air observations as a minimum basis to which the more comprehensive, yet less accurate, satellite data can be added. The limitations of our present ocean networks are only too apparent. Even in the Atlantic Ocean a hurricane could go undetected but for the surveillance of the weather satellite.

It is well known that small-scale features are often of greater importance in their

effects than large-scale weather systems. We have only to think, on a decreasing scale, of the hurricane, the thunderstorm and the tornado to appreciate this. While numerical models can be expected to forecast the broad-scale weather pattern in an ever-more efficient manner and, within limits, gradually increase the time for which the forecast is valid, there remains the relatively small-scale detail which is of such vital importance and is so difficult to handle.

New and more sophisticated numerical weather prediction models are using smaller grids for their calculations, calling not only for more elaborate analyses, but also for better and more numerous observations. Progress in forecasting weather detail will be made but the gains are not likely to be impressive even in comparatively dense-data regions. In the data-sparse areas, however, the addition of relatively few suitable upper-air observations will lead to effective and important improvements in broad-scale forecasting, improvements which in other more fortunate areas are already being realized.

REFERENCES

1. BUSHBY, F. H. Numerical weather prediction. *Mar. Obsr, London*, **38**, No. 220, 1968, pp. 80–83.
2. COX, W. J. Upper-air observations from a merchant ship. *Mar. Obsr, London*, **38**, No. 222, 1968, pp. 189–192.

ICE CONDITIONS IN AREAS ADJACENT TO THE NORTH ATLANTIC OCEAN FROM JULY TO SEPTEMBER 1971

With effect from this edition the style of the article on ice will be altered so as to present as much data as possible in chart form and to reduce discussion to significant features only. The charts display the actual and normal ice edges (4/10 cover), sea-surface and air temperatures and surface-pressure anomalies (departures from the mean) so that the abnormality of any month may be readily observed. (The wind anomaly bears the same relationship to lines of equal pressure anomaly as wind does to isobars. Buys-Ballot's law can therefore be applied to determine the direction of the wind anomaly.) The summary of iceberg sightings has been discontinued and is replaced during the iceberg season (roughly February to July) by southern and eastern iceberg limits. In any month when sightings have been abnormally frequent (or infrequent) this will be discussed briefly in the text.

The periods used for the normals are as follows. Ice: Eurasian sector, all data up to 1956,[1] North American sector, 1952–56 (for north of 68°N)[1] and all data up to 1963 (for south of 68°N).[2] Surface pressure: 1951–66.[3] Air temperature, 1951–60.[4] Sea-surface temperature: area north of 68°N, 1854–1914 and 1920–50,[5] area south of 68°N, 1854–1958.[2]

July

The most significant ice features on the July chart are the excessive conditions over the central part of the Greenland Sea and in the Kara Sea. In the former area the advance east and south-east was largely due to a westerly wind anomaly; at one stage open pack-ice completely bridged the Denmark Strait, an almost extreme condition, causing a British trawler to abandon a north-about return passage from north-west Iceland. The stronger north-westerly wind anomaly further north served to remove the large deficit of last month in the region north of 70°N. The Kara Sea excess was due to the persistence of excessive conditions in June, the north-easterly wind anomaly of July contributing little to the reduction of this excess.

August

Despite an adverse wind anomaly in the Denmark Strait seasonal melting eventually prevailed and the ice excess was limited to the area north of 69°N. Southerly winds over the Kara Sea reversed the ice anomaly in that region. Though ice conditions remained lighter than normal over the Canadian Arctic Archipelago, the deficit was reduced by a north-westerly wind anomaly resulting in an arrest in the rate of melting, though this same wind anomaly (associated with westerly winds) was directly responsible for the clearance of open pack-ice from the windward end of Viscount Melville Sound.

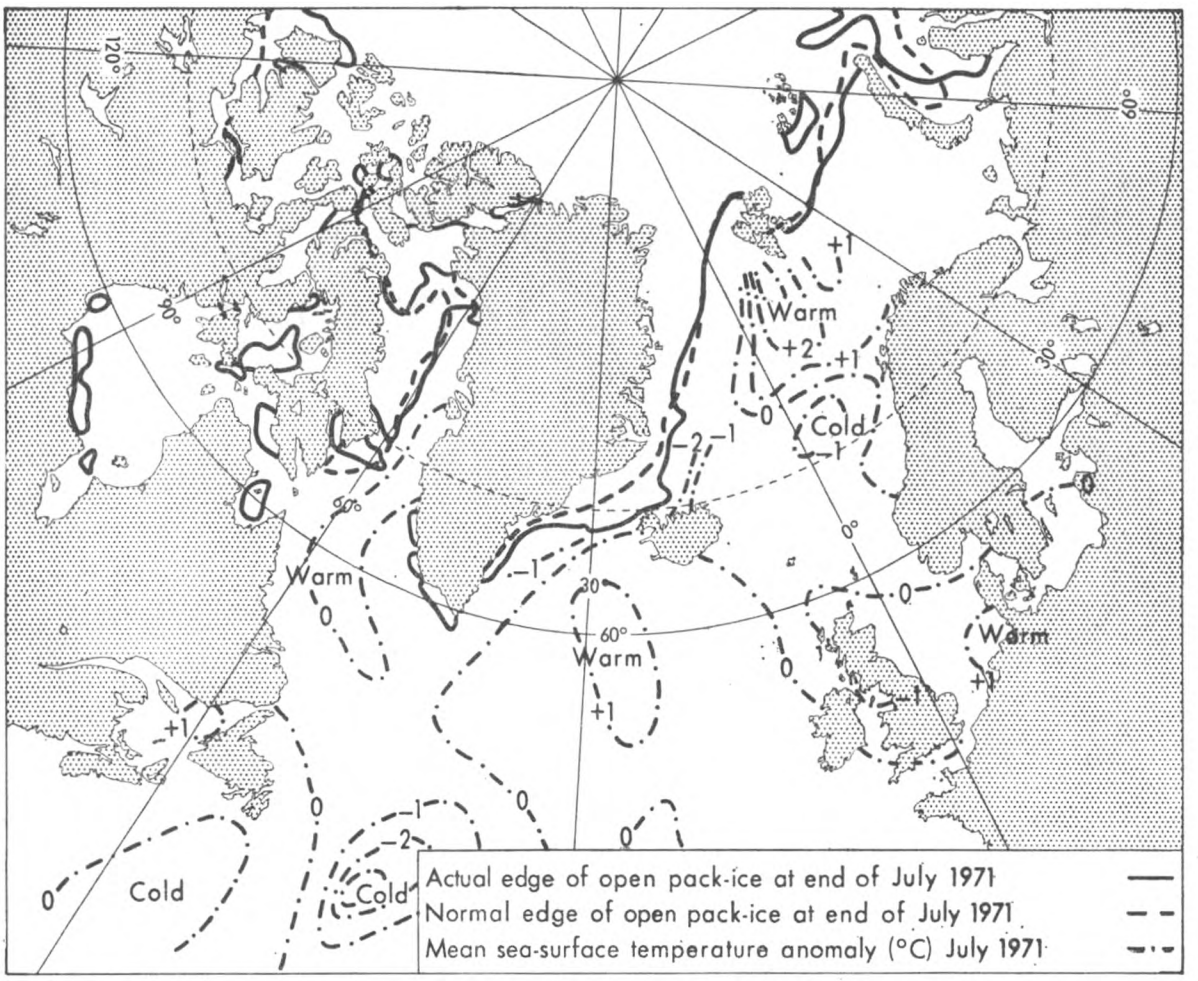
September

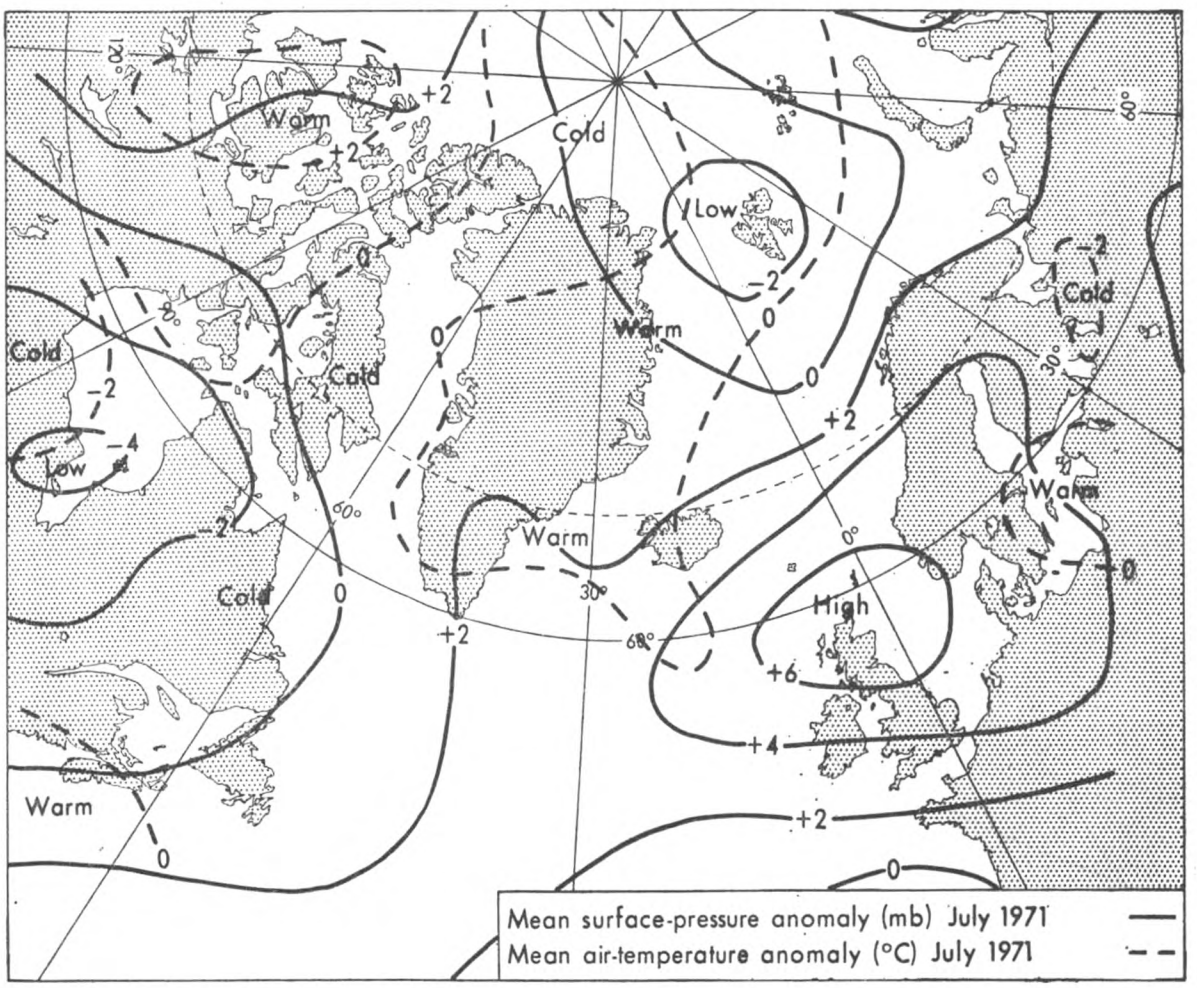
Stronger than normal north-easterly winds maintained excessive ice conditions over the central Greenland Sea. An ice deficit persisted over the Canadian Arctic Archipelago and the Kara Sea. This was largely due to the fact that the normal rate of cooling over the Arctic Basin had been reduced, probably by increased cloud cover, so that the region was warmer than normal. Therefore winds from the north-west quadrant (normal at this time) would be less cold and, as a result, the new season's freezing over the Archipelago would be behindhand. Unusually large numbers of icebergs were reported on the 5th by aircraft reconnaissance on the western side of Davis Strait northward of 62°N. At the end of the month these icebergs, if they had resisted melting, should have drifted down the Labrador Coast at least as far as Hopedale, but reports from this coast suggested near-normal iceberg counts.

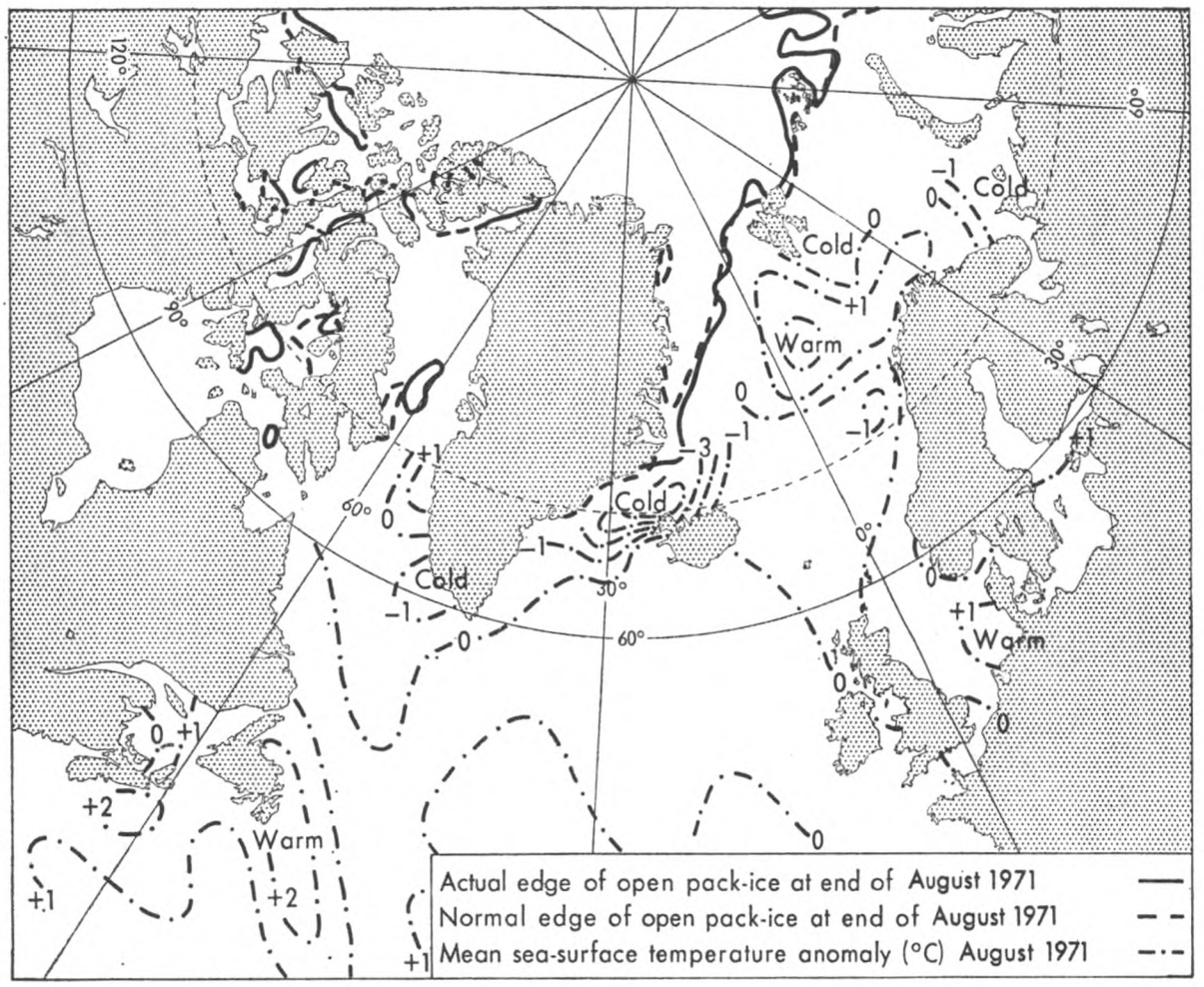
R. M. S.

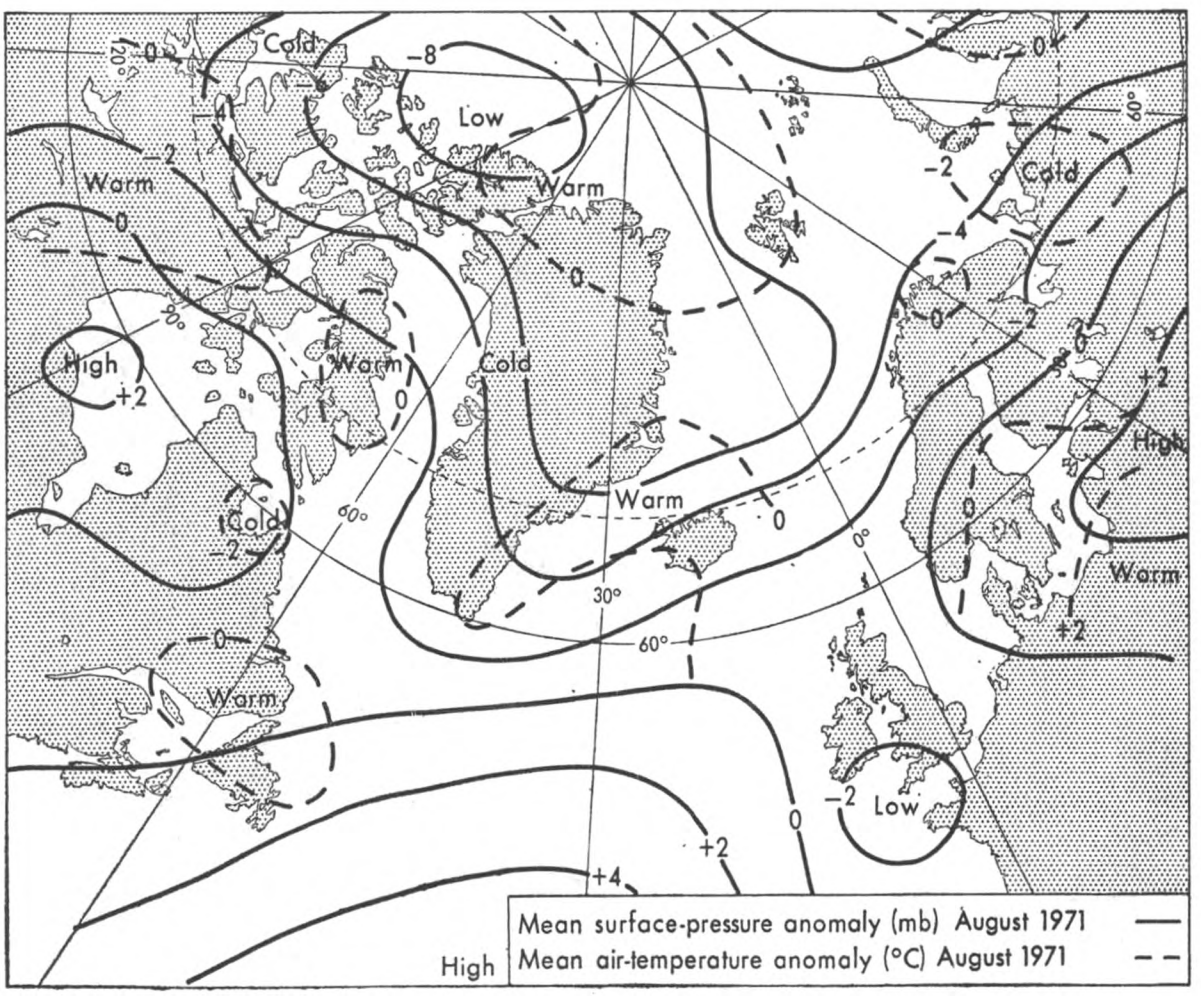
REFERENCES

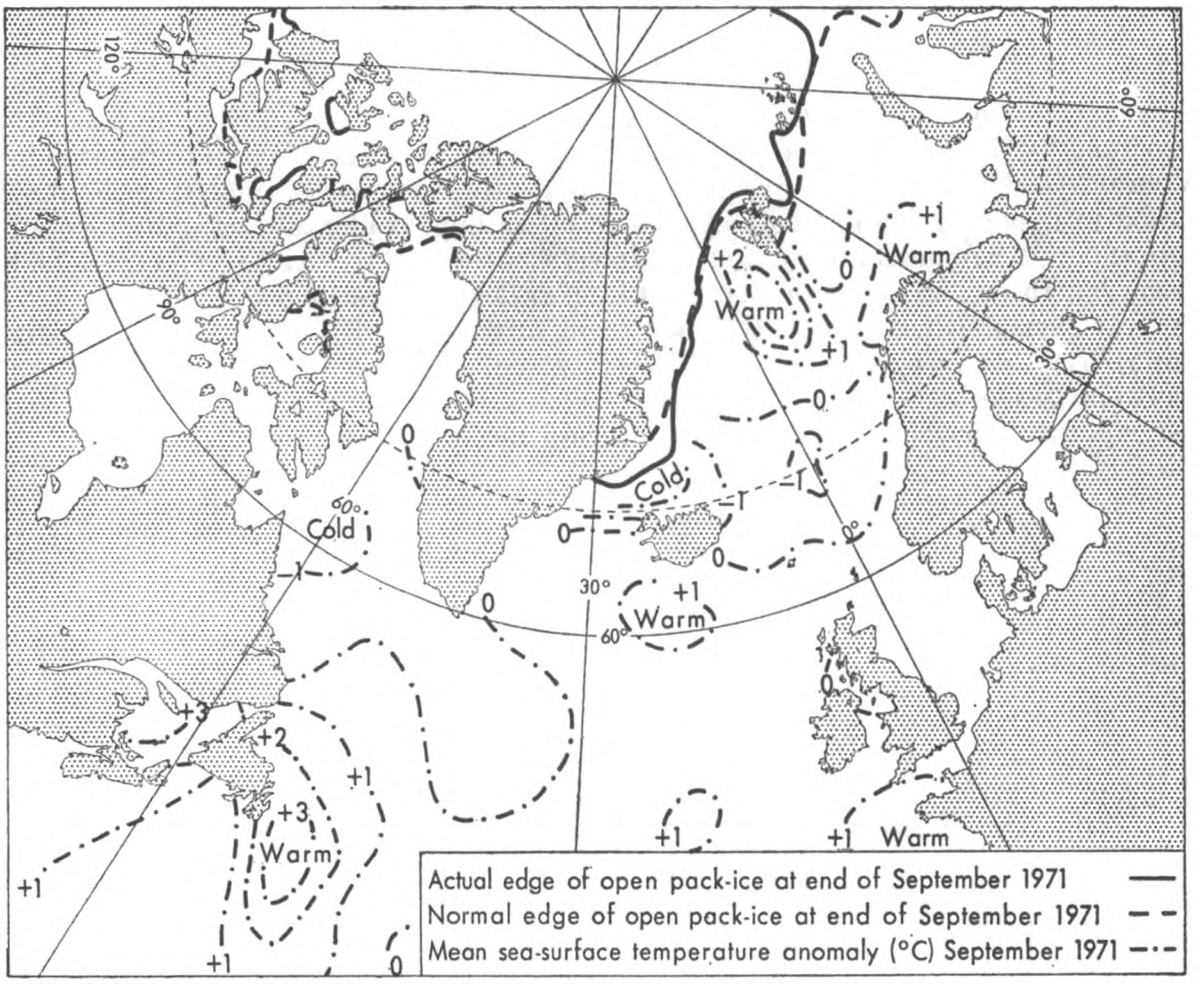
1. Washington, D.C., U.S. Navy Hydrographic Office. Oceanographic atlas of the Polar Seas. H.O. Pubn. No. 705, Part II: Arctic, 1958.
2. Washington, D.C., U.S. Naval Oceanographic Office. Oceanographic atlas of the North Atlantic Ocean. Pubn. No. 700, Section III: Ice, 1968.
3. London, Meteorological Office. Various publications.
4. Washington, D.C., U.S. Department of Commerce Weather Bureau. World weather records, 1951–60. Vol. 1: North America, 1965.
5. London, Meteorological Office. Monthly meteorological charts and sea surface current charts of the Greenland and Barents Seas. Met.O.575, 1966.


Actual edge of open pack-ice at end of July 1971
Normal edge of open pack-ice at end of July 1971
Mean sea-surface temperature anomaly (°C) July 1971
Warm
Cold
120°
60°
30°
0°
60°
30°


Mean surface-pressure anomaly (mb) July 1971
Mean air-temperature anomaly (°C) July 1971
Warm
Cold
Low
High
120°
60°
30°
0°
60°
30°


Cold
Warm
Actual edge of open pack-ice at end of August 1971
Normal edge of open pack-ice at end of August 1971
Mean sea-surface temperature anomaly (°C) August 1971


Cold
Low
Warm
High
Mean surface-pressure anomaly (mb) August 1971
Mean air-temperature anomaly (°C) August 1971


Actual edge of open pack-ice at end of September 1971
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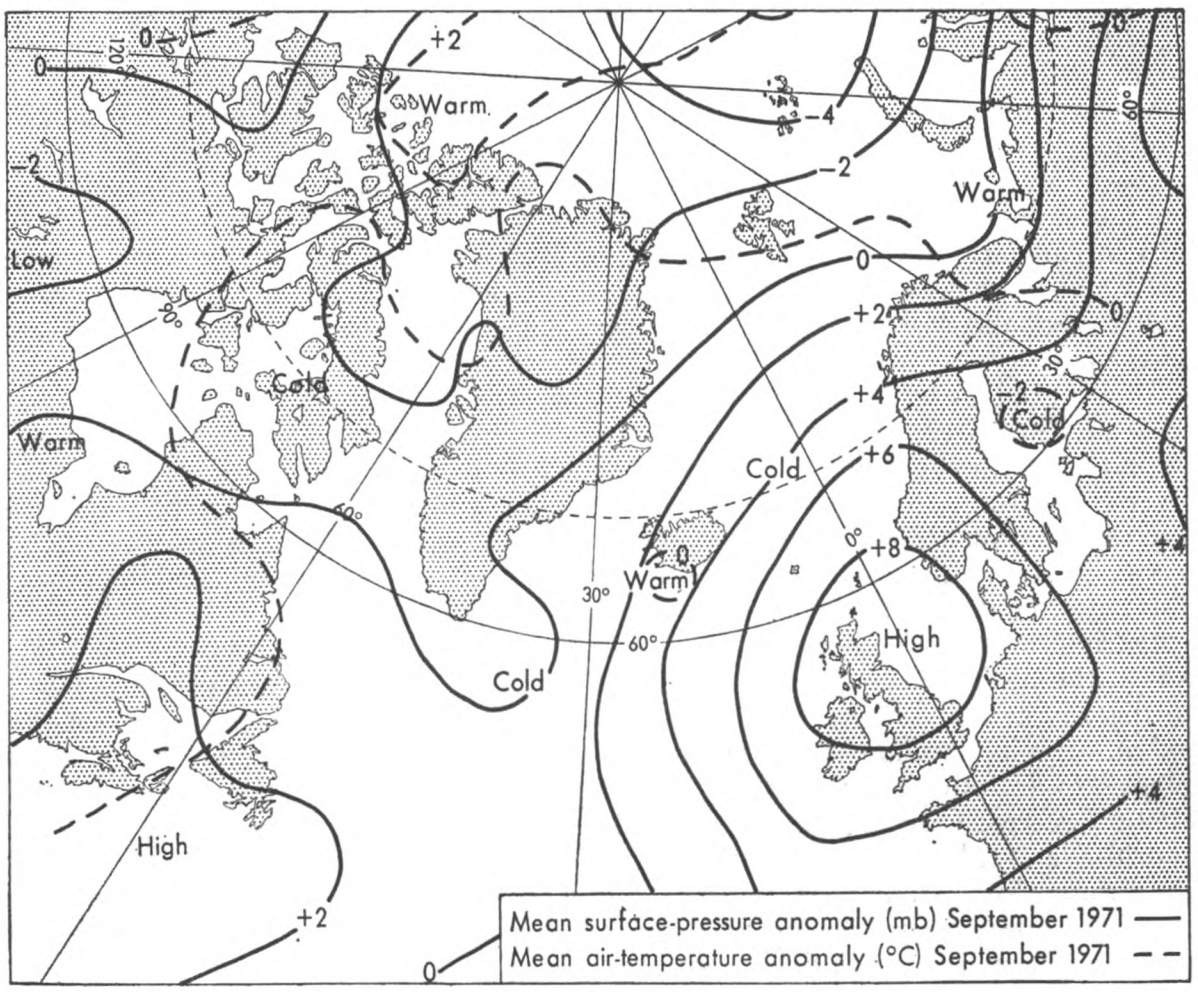
Mean sea-surface temperature anomaly (°C) September 1971
Warm
Cold
120°
90°
60°
30°
0°


Mean surface-pressure anomaly (mb) September 1971
Mean air-temperature anomaly (°C) September 1971
Warm
Cold
Low
High
120°
90°
60°
30°
0°

TRIBUTE TO THE s.s. *KAMPALA*

(From the Deputy Director-General of Observatories (Forecasting), India)

The s.s. *Kampala* of the British India Steam Navigation Co. Ltd., London was recruited by the India Meteorological Department as a Selected Ship in the Indian Voluntary Observing Fleet in December 1948. By her close co-operation she rendered valuable service to this Department in sending regular and accurate weather reports. For her outstanding and meritorious work she received eleven Excellent Awards; (these awards were instituted by this Department in 1951).

Now that she has been withdrawn from service and sailed her last voyage in June 1971 this Department would like to place on record its appreciation of the Masters and other officers who served in this ship from time to time. We are grateful for their valuable contribution during our long association with this ship.

Book Reviews

Ships and Shipping, by M. D. Palmer. 10 in × 7½ in, pp. 96, *illus.* B. T. Batsford Ltd., 4 Fitzhardinge Street, London W1H 0AH, 1971. Price: £1·30.

Hollowed-out tree trunks shaped to the form of canoes can still be seen in use in some parts of the world today. This was one of the earliest forms of water transport and in this book the author traces the progress and development of water craft from this very primitive form through the various stages including Viking longboats, caravels, sailing ships, ocean going paddle ships, screw-propelled steam and motor ships to those propelled by nuclear power. Reasons for many changes and developments in design of hulls and methods of propulsion are clearly explained.

Venice became the greatest city of the Mediterranean when the Crusaders established feudal kingdoms in Palestine and Syria, and Christians were able to trade direct with ports of the east Mediterranean which had trade links with India and China by land and eventually by sea. In early days London, the most important port in England, did not exercise much control over the trade of northern Europe but English wool, our principal product of the period, was finding a ready market in Flanders and so our progress as traders is followed through the ages and to all parts of the globe.

Trades, industries and ships could not prosper without good harbours and docks and one chapter of this book is devoted to the development of ports going back to the seventeenth century and explaining how London became a barge port and also gives interesting information on many of the docks in the Port of London. Political moves to nationalize British ports and the effect a change of government has had, labour relations in docks and changes in methods of handling cargo, also the introduction of container traffic all receive adequate comment.

During the late nineteenth and early twentieth century British merchant shipping was at the peak of its supremacy but by 1914 other nations were challenging some British markets and then, with the onset of World War I and the consequent heavy toll on shipping by the U-boat menace, our supremacy started to decline. The author goes on to describe the industrial and shipping slump that followed that war, the end of the free trade era in the thirties and the part played by merchant shipping in World War II. The fact that casualties in the armed forces during World War II were much lower than those in World War I yet Merchant Navy casualties were more than double is not widely known and seldom appears in print although our staggering tonnage losses during the two wars are sometimes mentioned.

(*Opposite page* 36)

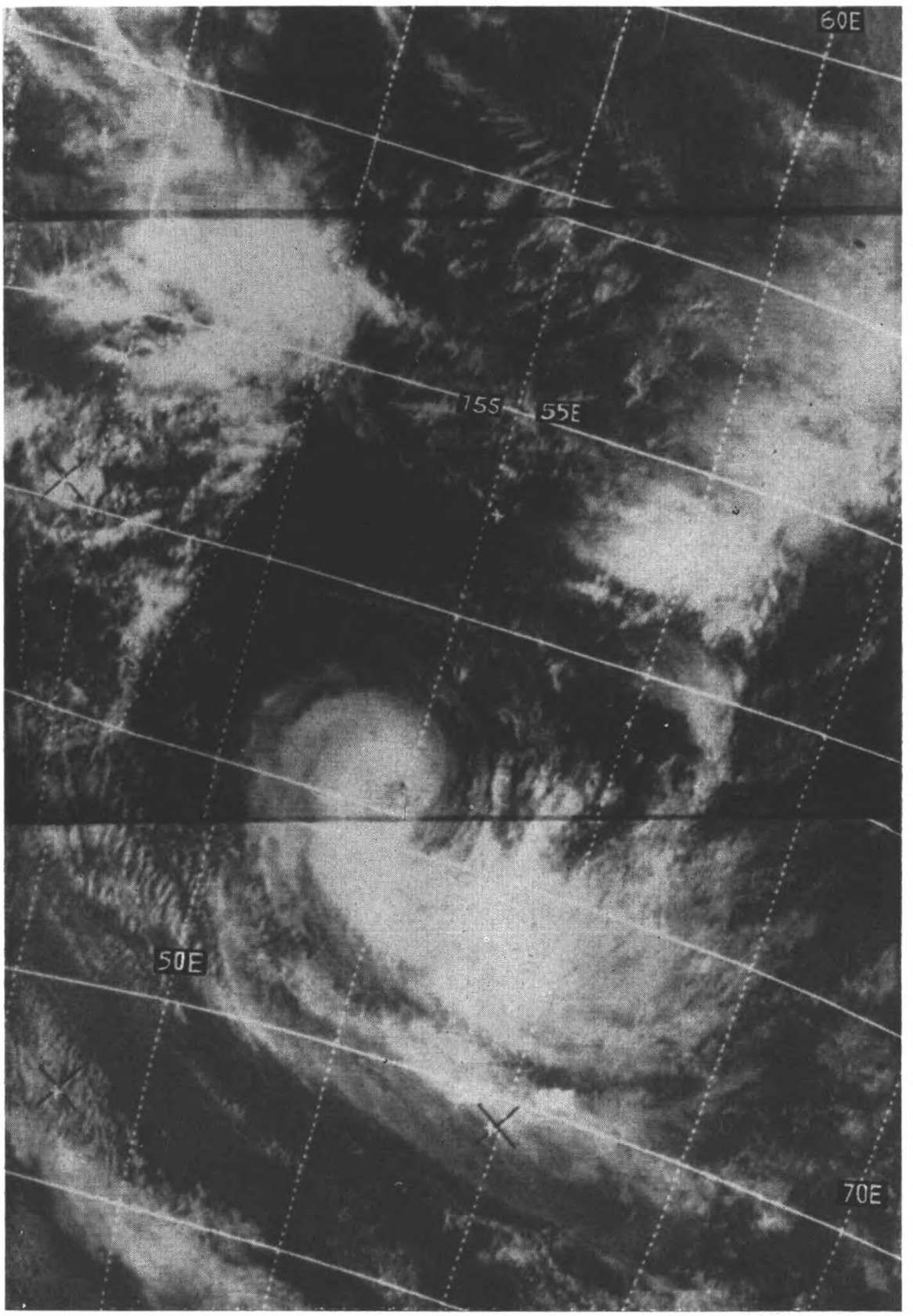


Photo by National Oceanic and Atmospheric Administration, U.S.A.

Cyclone Ginette televised from ITOS 1 weather satellite at about 1130 GMT on 25th January 1971. The eye of this intense cyclone is clearly displayed (*see* page 8).

(*Opposite page* 37)

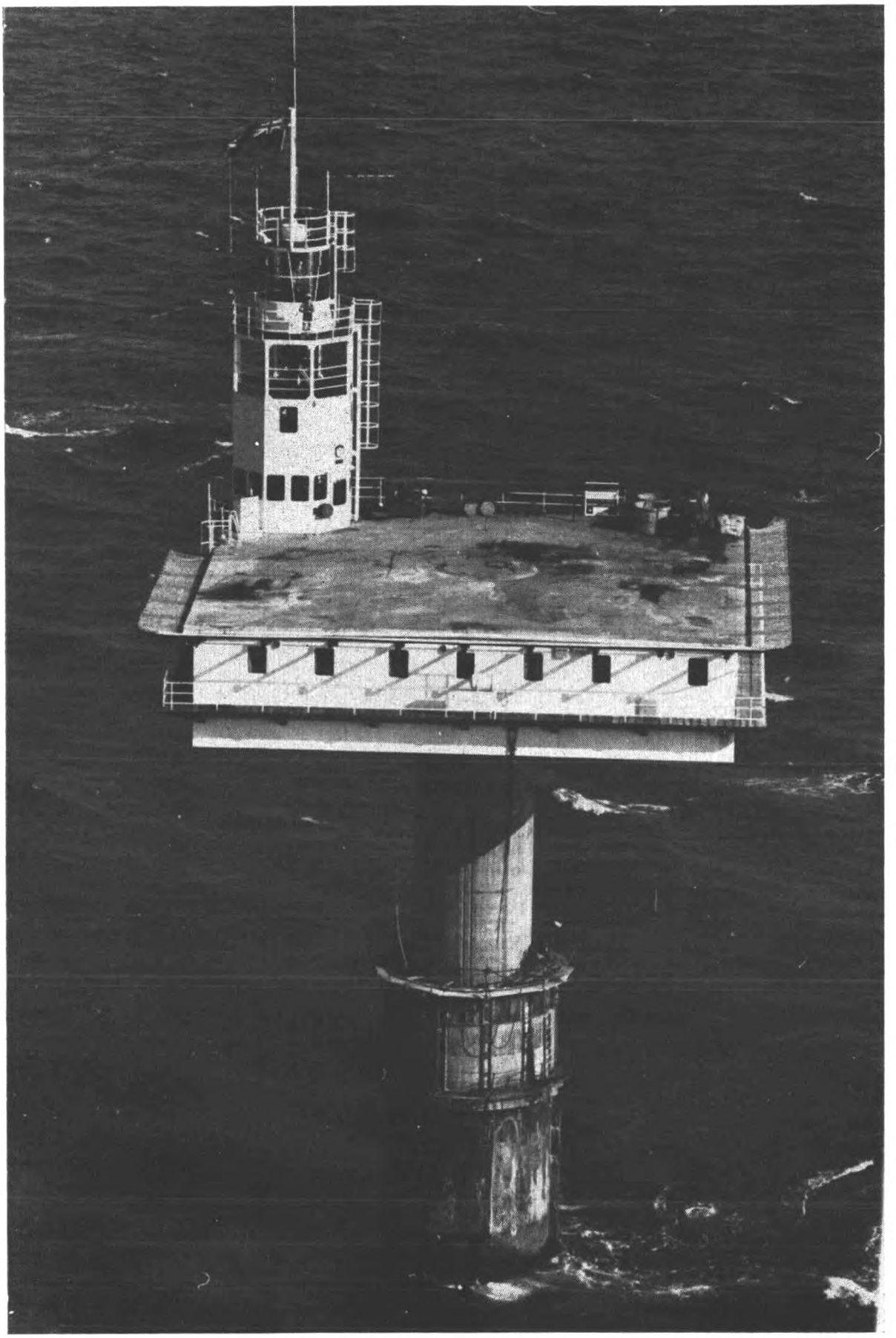


Photo by Keystone Press Agency Ltd.

Trinity House's new Royal Sovereign Light-tower, 115 ft high, off Beachy Head, Sussex. The light-tower became operational on 6th September 1971 and replaced the light-vessels which had marked this position for 96 years.

This book is one of the 'Past-into-Present Series' produced for schools and especially those whose studies are geared to the C.S.E. It is well written, excellently illustrated, clearly indexed and published at a most modest price. If other books in this series are of a similar quality they will undoubtedly contribute much to education and pleasant, interesting reading.

G. A. W.

The Naval War against Hitler, by Donald Macintyre. 9 in × 6 in, pp. 376, *illus.* B. T. Batsford Ltd., 4 Fitzhardinge Street, London, W1H 0AH, 1971. Price: £3·50.

Many books have been written describing naval battles of World War II and enter into lengthy post-mortems but few, if any, have covered so many theatres of operations and kept realistically to the facts. Captain Donald Macintyre, a distinguished Naval Officer, has written several books on naval warfare and can be considered an outstanding naval historian so readers would be right in assuming that this, his most recent book, should make interesting reading.

Hitler's Navy fired its first shot of the war early in September 1939 at a defenceless merchant ship but the prologue of this book really starts with the Battle of the River Plate which finally resulted in the scuttling of the pocket-battleship *Admiral Graf Spee* and the suicide of her Commanding Officer, Captain Langsdorff. In those early days of the war when the Allied Armies and Air Forces were fully occupied in preparing for battle this naval encounter attracted much publicity and it was rightly assumed that the first round had gone to the Royal Navy but much more was to follow and it is plainly seen in the ensuing chapters that the enemy came surprisingly close to successfully conquering allied shipping.

The Battle of Narvik is described in great detail. The part played by the Royal Navy and small craft in the evacuation of British and Allied forces from Europe, together with statistics of troops involved, is fully covered and so the author continues with the Battle of the Atlantic and the build-up of German U-boats and the activities of the 'wolf packs' in that area. This was possibly the longest and the most drawn out of all campaigns during World War II and one that Britain came very close to losing; the consequences of such would have been catastrophic.

The successful passage of the German warships *Scharnhorst* and *Gneisenau* through the English Channel and Admiral Raeder's ambitious hopes of the *Bismarck*, *Prinz Eugen*, *Scharnhorst* and *Gneisenau* defying the British Navy, the operation which finally resulted in the sinking of the *Bismarck* are adequately described.

The effect of naval power on the land forces in Egypt and North Africa is clearly explained. The importance of getting even two or three merchant ships through to Malta during the dark days of continuous bombardment of that small island are covered, together with numerous other battles, in the three phases of the Mediterranean campaign. Not only the heroic deeds of those of the Royal and Allied Navies are recorded but also many of those of the enemy and included amongst these is the successful Italian attack by the two-men 'chariots' on the British battleships *Valiant* and *Queen Elizabeth* in Alexandria Harbour during December 1941.

Several chapters are devoted to Russian convoys and naval operations in the cold, hostile waters of the Arctic which, alone, can be unpleasant enough at the best of times. The activities surrounding the PQ17 convoy which has received considerable publicity are described in some detail and again the author has kept to the facts without expressing any personal views. Possibly the best description of a naval engagement in this book is the sinking of the *Scharnhorst* after all the care and consideration Hitler and Admiral Dönitz had given to her safety and it was this successful engagement which finally secured the free passage of Allied shipping, by the northern route, to Russia.

The last chapter deals with the Allied invasion of Europe and in order to complete this massive and large-scale operation Allied sea supremacy was essential and although the Allies at that time controlled the seas there were still many problems and hazards to be overcome.

This well-illustrated and comprehensively-indexed book does not simply record naval battles and statistics of World War II but it is also about the many thousands of men in several Navies and many kinds of ships that played a very active part. Many of those that sailed in these areas of operations and were fortunate enough to survive will no doubt read this book with keen interest remembering, perhaps, the days when they saw a convoy lit up in the ghostly glare of 'Snowflakes' or, perhaps, looking into the rising Mediterranean sun watching intently for the approach of enemy aircraft. To others it may bring back memories of the long Arctic nights experienced on the Russian convoy route and the fears of air, surface or U-boat attack. Many who have been fortunate enough not to become involved in war at sea should find this an enthralling book, bearing in mind that it is fact not fiction, and they may possibly wonder, at times, how it could come about that we should eventually win.

G. A. W.

Personalities

RETIREMENT.—CAPTAIN A. J. F. COLQUHOUN, M.B.E. retired from the sea and from command of the *Eucadia* in September 1971.

Angus James Forrest Colquhoun was born in 1907 and commenced service at sea in 1923 when he joined the Anchor Line as a Cadet in their *Olympia*. He obtained his Second Mate's certificate in 1927 and served in various companies until he returned to the Anchor Line with a Master's certificate as 3rd Officer of the *Transylvania*.

He was appointed to his first command, the *Tarantia*, in 1951 and held command of various ships with the Anchor Line until his retirement. He was awarded the M.B.E. for meritorious service as Chief Officer of the *Carmania* when this vessel was torpedoed off North Africa in 1942 but was brought safely into the port of Bougie.

Captain Colquhoun's association with the Meteorological Office goes back to 1925 when he was a Cadet in the *Olympia* and, during 46 years as a Voluntary Observer, 52 meteorological logbooks have been returned bearing his name as Captain or Observing Officer. Twenty-nine of these logbooks were classed Excellent. He received awards in 1954, 1963, 1964, 1965, 1966 and 1967, and the special award of a barograph in 1969.

We wish him health and happiness in his retirement.

F. G. C. J.

RETIREMENT.—CAPTAIN R. G. E. GRANT of the Shaw Savill Lines has retired after 50 years at sea.

Richard George Edward Grant was born in London and spent his boyhood at Leigh-on-Sea; his maternal grandfather was a Deal Pilot.

In 1921 he went to sea as Deck Boy in the Shaw Savill-White Star liner *Corinthic*. He worked his way through the foc's'le until he became Quartermaster in Shaw Savill's and then sat and passed for 2nd Mate in 1927.

Although he was then offered a 4th Officer post with Shaw Savill's he decided to gain experience elsewhere and joined the *Maid of Psara*, belonging to a London

Greek firm, as 3rd Mate. He made one voyage in her and then joined the General Steam Navigation Company's *Albatross*; he stayed with them until he passed for Master in 1932.

In May 1933 he returned to Shaw Savill's as 4th Officer of their *Esperance Bay*. He was appointed to his first command, the *Mahia*, in 1952 and subsequently commanded a number of Shaw Savill's ships including the new *Corinthic*, the nominal successor of the ship in which he had gone to sea as Deck Boy 46 years before.

In the latter part of 1939 Captain Grant was 2nd Officer of the *Waimarama* when she met the German supply ship *Adolf Woermann* in the South Atlantic. This occurrence was reported to the Admiralty and the *Waimarama* shadowed the German ship for about 24 hours until a British cruiser arrived in the area. Later on in the war, in 1941 when he was still 2nd Officer of the *Waimarama*, whilst on passage from Liverpool to Alexandria via the Cape of Good Hope (access to the Mediterranean being at that time virtually denied to the Allied fleets) with a cargo of war stores for the sore-pressed Eighth Army, his ship grounded near Rosetta and her steering gear was crippled. A little over a day later she refloated and managed to reach Alexandria where she remained for about four months awaiting repair and in the meantime being used as a refrigerator for the perishable stores of the forces in the Western Desert.

Captain Grant is a Younger Brother of Trinity House.

Our association with him goes back to 1934 when he sent us a meteorological logbook from the *Esperance Bay*. Since then, in 19 years of voluntary observing, he has sent us 44 logbooks; he received Excellent Awards in 1938, 1939, 1965, 1967 and in 1971, his last year at sea.

We wish him health, happiness and serenity in his retirement and many years to enjoy his twin hobbies of golf and gardening.

L. B. P.

RETIREMENT.—Captain G. H. Heywood retired from the sea at the end of August when he brought the *Akaroa* home to go on the sale list.

George Halliley Heywood was born in Bristol and, at the age of 16, signed indentures with the Hain S.S. Co. being appointed to their *Tredenham* in Avonmouth in May 1923. He served his full four years' apprenticeship in the one ship and passed for 2nd Mate in July 1927.

He then joined Trinder Anderson's as 3rd Officer of their *Atholl* and remained in the Company until he passed for Master in October 1930. This was the year in which the great shipping depression reached its very nadir and Captain Heywood was virtually unemployed for the next two years; during this time he worked his way out to New Zealand looking for a job and, being unsuccessful, worked his way home again. Success came in November 1932 when he joined the Shaw Savill & Albion Company as 4th Officer of their *Akaroa*.

During World War II when he was Chief Officer of the *Largs Bay*, then requisitioned as a troopship, his ship was mined off Naples at the time of the Anzio landing and he was officially commended for his part in getting her safely into port.

Captain Heywood was appointed to his first command, the *Karamea* in March 1949; she and the *Mahia* were the only two of his eight commands which remained in the Company after he had left them. The other six, *Raranga*, *Moreton Bay*, *Athenic* (which he had for twelve years), *Aranda*, *Arawa* and *Akaroa*, he handed over either to buyers or ship-breakers. In fact, as he says, perhaps it is as well that he had to retire before Shaw Savill ran out of ships!

Amongst the treasures which Captain Heywood accumulated during his 48 years

at sea, he prizes a carved wooden replica of Captain Bligh's Bible which was given to him by the good people of Pitcairn on his fiftieth and last visit to the island.

Captain Heywood's record of voluntary observing goes back to 1933 when he sent us his first meteorological logbook from an older *Akaroa*; in all he has 19 years of voluntary observing to his credit during which he has sent us 38 meteorological logbooks, 21 of which have been classed Excellent. He received Excellent Awards in 1959, 1961, 1964, 1968 and 1969.

We wish him health, happiness and serenity in his retirement.

L. B. P.

Notices to Mariners

NEW STORM INFORMATION SERVICE

The U.S. Department of Commerce's National Weather Service and National Bureau of Standards have established a new storm information service for deep-water sailors in the Atlantic and Pacific.

The new service consists of hourly broadcasts of up to 42 seconds each giving information about major storms that might produce trouble for ships at sea. The weather broadcasts are superimposed on Bureau of Standards time signals carried by stations WWV and WWVH.

The broadcasts will be made around the clock. Station WWV will carry information about storms in the western North Atlantic, 16 minutes after every hour, on radio frequencies 2·5, 5, 10, 15, 20 and 25 MegaHertz. WWVH will list storms in the eastern and central part of the North Pacific, 49 minutes after every hour, on 2·5, 5, 10, 15 and 20 MHz. The ocean areas involved are those for which the U.S. has warning responsibility under international agreements.

If there are no storm warnings in the designated areas, the broadcasts will so indicate. The brief messages are designated to tell mariners if there are storm threats in their areas—not to provide complete information. Mariners are expected to check with one of the regular marine broadcasts for details.

The following is a hypothetical broadcast to show the type of information mariners can expect to receive in the new service:

> North Atlantic weather, west of 35 degrees West, 1500 GMT, Hurricane Donna, intensifying, 24 North, 60 West, moving northwest, 20 knots, winds 75 knots . . . Tropical Storm Eve, 17 North, 50 West, moving east, 10 knots, winds 50 knots . . . Storm, 65 North, 35 West, moving east, 10 knots, winds 50 knots, seas 15 feet.

CAUTION ISSUED BY THE DANISH AUTHORITIES

(Translation received from the Hydrographer of the Navy, Taunton)

Denmark—The Sound—east of Kastrup Lufthavn—position approx. 55° 37′N, 12° 41′E. Up to a distance of about 2·7 miles from Copenhagen Airport, Kastrup area, during certain conditions, eddies may occur which can develop into water-spout-like phenomena a short time after heavy aircraft (the so-called Jumbo jets) have overflown the area at a relatively low altitude. The eddies create a danger to fishing boats and pleasure craft. In up to 2–3 minutes after such an aircraft has passed the area two series of eddies can arise comparatively short distances apart, extending from the coast outwards. The individual eddies have a horizontal and vertical extent of a few metres. The tangent velocity in the eddy can be of hurricane strength.

Fleet Lists

Corrections to the list published in the July 1971 number of *The Marine Observer.*

Information regarding these corrections is required by 20th October each year. Information for the July lists is required by 20th April each year.

GREAT BRITAIN (Information dated 1.10.71)

The following coasting vessels ('Marid' ships) have been recruited:

NAME OF VESSEL	CAPTAIN	OWNER/MANAGER
Elk	C. F. Creed	British Railways Board
Moose	M. Hurd-Wood	British Railways Board

The following vessels have been deleted:

Corkbrook, Fallowfield, Oreosa, Spartan Prince

The following skippers and radio operators have been added to the Trawler Fleet List:

SKIPPER	RADIO OPERATOR	TRAWLER OWNER/MANAGER
D Auckland	M. R. Read	Northern Trawlers Ltd.
R. Crickmore	W. J. Teare	Hellyer Bros. Ltd.
A. Fieldsend	C. Hodder	Hellyer Bros. Ltd.
C. A. Grimmer ..	F. R. Hailstones	R. Irvin & Sons Ltd.
H. Hall	M. R. Read	Northern Trawlers Ltd.
J. N. Kerr	M. Webb	Ross Trawlers Ltd.
P. McCarthy	A. S. Wittlin	Ross Trawlers Ltd.
F. Penistone	P. R. Hickson	Goweroak Ltd.
D. T. Pulfrey	D. Jardine	Goweroak Ltd.
G. Smith	A. J. Nettleship	Hellyer Bros. Ltd.
J. A. Williams ..	C. Bird	Boyd Line Ltd.

GREAT BRITAIN (*contd.*)

The following ships have been recruited as Selected Ships:

NAME OF VESSEL	DATE OF RECRUITMENT	CAPTAIN	OBSERVING OFFICERS	SENIOR RADIO OFFICER	OWNER/MANAGER
America Star	14.5.71	J. S. Hunter	B. Thompson, C. Elms, R. D. Hodgkinson	J. C. Martin	Blue Star Line Ltd.
Baron Ardrossan	26.8.71	J. Hetherington	D. Houston, A. MacLeod, C. G. Stephenson	G. Walker	Scottish Ship Management Ltd.
Bendearg	18.6.71	W. C. Watson	J. N. Allan, M. D. Humby, I. A. MacIver	P. McMeeking	Ben Line Steamers Ltd.
Benefactor	15.7.71	W. G. Jackson	G. Harfoot, J. Perkis, R. Maxwell	F. Smyth	T. & J. Harrison Ltd.
Britannic	15.7.71	W. A. Murison	P. R. Brown, R. I. G. Calder, R. D. Mallam		Shaw Savill & Albion Co. Ltd.
British Holly	19.5.71	C. D. Brown	A. Hedgeland, D. Brown, M. J. Carnell, N. Ricketts		B.P. Tanker Co. Ltd.
British Valour	21.5.71	F. A. Frost	R. P. Goodall, R. Simpson, G. C. Main	R. Lodge	B.P. Tanker Co. Ltd.
C.P. Discoverer	21.7.71	J. D. Jeavons	P. F. Wright, A. McGrail, E. J. O'Toole	M. Harrison	Canadian Pacific Steamships Ltd.
C.P. Trader	26.5.71	J. Richardson	A. R. Baker, G. B. Drewery, R. Triggs	G. Whittaker	Canadian Pacific Steamships Ltd.
Chakdara	26.8.71	D. P. Barry	R. H. M. Syvret, K. A. Long, R. Tull	J. Field	British India S.N. Co. Ltd.
City of Auckland	11.8.71	T. Rigg	A. A. Thorpe, D. G. Pounder		Ellerman Lines Ltd.
Cumbria	25.6.71	W. Lewis	M. Glasgow, B. Willson, P. Carr	B. Milligan	Hadley Shipping Co. Ltd.
Dart Atlantic	24.5.71	E. Irish	H. J. Henderson, D. King, M. Pain	N. Wilbert	Bristol City Line Ltd.
Dunkwa	6.9.71	F. N. Howe	G. F. Grant, A. C. Temple, D. McKenzie	R. Davies	Ocean Fleets Ltd.
Furness Bridge	30.7.71	J. L. Gilzean	M. W. Porter, D. M. Allan, D. Bayliss	R. Gartland	Furness Withy & Co. Ltd.
Geest-tide	2.9.71	P. W. Groves	K. Slade, G. Foster, M. Talbot	J. Conway	Geest Industries Ltd.
Haminea	25.6.71	C. Hindess	P. Shefford, R. Kurtin, C. Bell	T. J. Sweet	Shell Tankers (U.K.) Ltd.
London Pioneer	9.6.71	R. Nelson	K. Ferries, G. Douglas, R. Berriman	D. McCallum	British & Overseas Freighters Ltd.
Manchester Crusade	6.4.71	D. Selwood	J. Norcliffe, M. Miles, D. Smith	W. Harrison	Manchester Liners Ltd.
Montreal Star	19.8.71	W. T. Pitcher	M. Cully, D. Robinson, D. T. Thomas		Blue Star Line Ltd.
Novelist	9.9.71	B. W. Jones	K. A. Ellis, G. Batchelor, D. Newton	P. Dennehy	T. & J. Harrison Ltd.
Ocean Monarch	16.9.71	B. A. Hills	D. Stansbury, M. Eden-Smith, J. Grant	W. Fryer	Shaw Savill & Albion Co. Ltd.
Sig Ragne	21.6.71	J. McNeil	P. McN. Kenny, K. Inglis, B. Jordan	G. J. Freeman	J. & J. Denholm Ltd.
Silverman	4.6.71	J. G. Tew	C. Thorpe, T. Wright, N. Liddell		Silver Line Ltd.
Tairea	19.5.71	T. E. Kelso	D. J. Robertson, L. D. Wood, R. W. Orme, L. Anderson	D. P. Hammond	British India S.N. Co. Ltd.
Temple Bar	8.4.71	T. Edge	J. C. Gillespie, G. Dobbie, J. Mackie	D. W. Humble	Scottish Ship Management Ltd.
Titan	4.5.71	R. J. Paterson	D. C. S. Thompson, I. Bease, D. Murphy, J. R. Reeve	P. Dolphin	Ocean Fleets Ltd.
Ulysses	25.6.71	R. W. Greenwood	J. S. Pinder, E. F. Farquharson, B. Cushman	P. J. A. Conell	Ocean Fleets Ltd.
Vulcain	8.4.71	A. L. Pigg	J. F. Flowerdew, F. Coomber, W. T. Elliott	G. J. O'Connell	Crawford S.S. Co. Ltd.
Willowbank	27.5.71	G. D. Scott	N. E. Maxwell, J. R. Mathews, S. Conn	I. S. Murray	Bank Line Ltd.
Zealandic	10.8.71	J. O. Williams	S. N. McCabe, G. Horn, R. Eastwood	J. Blane	Shaw Savill & Albion Co. Ltd.

The following ships have been recruited as Supplementary Ships:

Invincible	25.3.71	R. Waller	A. Ramsay	A. Ramsay	British United Trawlers Ltd.
St. Giles	9.5.71	J. W. Humphrey	H. G. Pask	H. G. Pask	T. Hamling & Co. Ltd.
St. Leger	22.4.71	A. T. Blenkin	R. T. Murphy	R. T. Murphy	T. Hamling & Co. Ltd.
Sangro	3.8.71	R. W. Massam	M. R. Bowler, R. Watson, M. Johnstone		Ellerman's Wilson Line Ltd.

The following Selected and Supplementary Ships have been deleted:

Aaro, Akaroa, Amoria, Andes, Aranda, Arawa, Athelcrest, Bankura, Beaverelm, Benalbanach, British Chivalry, British Splendour, Chindwara, City of Birmingham, City of Chester, City of Exeter, City of Manchester, Clan Maclennan, Clan Sutherland, Crofter, Delphic, Deucalion, Devon, Empire Star, Imperial Star, Joseph Conrad, Kenuta, Lombardy, Malancha, Manchester City, Manchester Renown, Mangla, Mawana, Media, Neleus, Nottingham, Orestes, Phemius, Port Victor, Port Vindex, Port Wellington, Richmond Castle, Ripon, Roonagh Head, Sylvan Arrow, Theseus.

BRITISH COMMONWEALTH

AUSTRALIA (Information dated 8.9.71)

The following have been recruited as Selected Ships:
Enna G (Nauru Pacific Shipping Line)
Iron Dampier (Broken Hill Pty. Co. Ltd.)
Malaysia (Austasia Line Ltd.)
Manora (British India S.N. Co. Ltd.)
Merkara (British India S.N. Co. Ltd.)
Nanchang (China Navigation Co. Ltd.)
Taiyuan (China Navigation Co. Ltd.)
Tenos (Containers Pacific Express Line)

The following ships have been deleted:
Bamora, Barpeta, Dorrigo, Tairea, Warina.

HONG KONG (Information dated 10.9.71)

The following ships have been recruited:
Coral Princess (China Navigation Co. Ltd.)
Nuddea (British India S.N. Co. Ltd.)
Tsingtao (China Navigation Co. Ltd.)

The following ships have been deleted:
Hai Meng, Helios, Hermod, Kwangsi, Taiyuan, Yochow.

INDIA (Information dated 1.9.71)

The following have been upgraded to Selected Ships:
Jag Kisan (Great Eastern Shipping Co. Ltd.)
Maha Raja (South East Asia Shipping Co. Ltd.)

The following have been recruited as Supplementary Ships:
Bailadila (Shipping Corporation of India Ltd.)
Cosmos Pioneer (Cosmosteels Private Ltd.)
Jalamangala (Scindia S.N. Co. Ltd.)
Jalamatsya (Scindia S.N. Co. Ltd.)
Jalatarang (Scindia S.N. Co. Ltd.)
Vishva Dharma (Shipping Corporation of India Ltd.)
Vishva Raksha (Shipping Corporation of India Ltd.)

The following have been upgraded to Supplementary Ships:
Desh Sevak (Shipping Corporation of India Ltd.)
Jag Anand (Great Eastern Shipping Co. Ltd.)

The following ships have been deleted:
Indian Shipper, Kampala, Jalamoti, Ranee.

NEW ZEALAND (Information dated 10.9.71)

The following has been recruited as a Selected Ship:
Act 3 (Blue Star Port Line Ltd.)

The following has been upgraded to a Selected Ship:
Luhesand (Holm Shipping Co. Ltd.)

The following has been recruited as a Supplementary Ship:
Jean Phillippe (Trans Pacific Marine Ltd.)

The following ships have been deleted:
Navua, Sedco 135F, Taranui.

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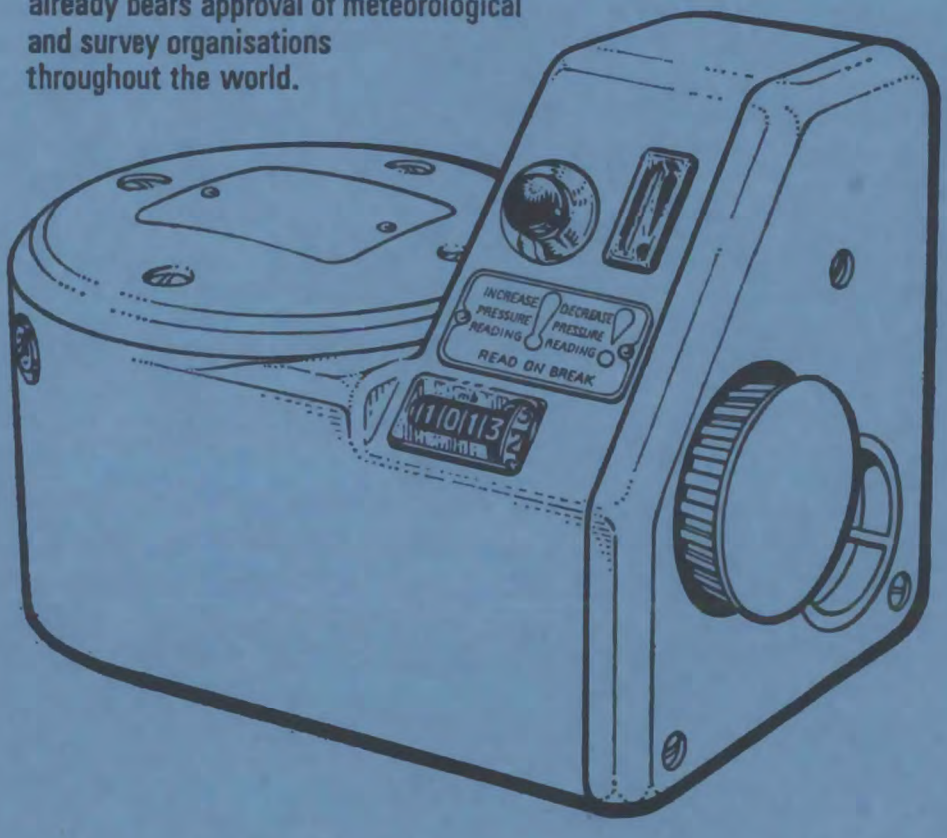

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